THE LOCOMOTIVE ENGINEER.

INDEX TO VOLUME I, 1888

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Correspondence

ASKED & ANSWERED.

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THE LOCOMOTIVE ENGINEER,

96 Fulton Street, N. Y.

THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. I. NO. I. NEW YORK, JANUARY, 1888. $1.00 per Year. or 10c. a copy.

From the Publishers' Standpoint.

That very many railway master mechanics and executive officers were once locomotive engineers and firemen is well known among railway men. Such officials, therefore, have a personal, as well as a professional concern in matters relating to the locomotive.

That many of the enginemen of to-day will step from the heroisms and responsibilities of the cab, to places of mechanical and executive control, is as certain as any future event can be. To such, also, the methods and appliances of the repair shop possess a double interest. Taking the locomotive as a complete machine at the hands of the designer and builder, it is evident, therefore, that there is, or should be, an intimate relation existing between the men who run it (many of whom have had more or less shop experience), and the roundhouse and repair shop employes, and master mechanics with whom they co-operate in the task of keeping it in condition to run. That this army of workers is known in railway circles to wield an influence in those circles, none the less potent because not fairly estimated outside, may be stated with entire confidence.

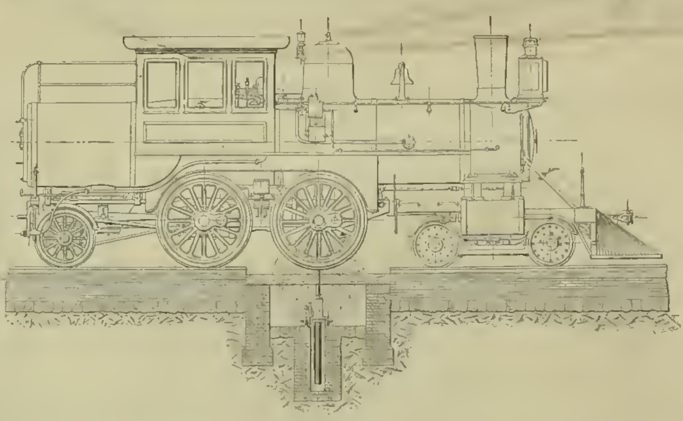
Unhampered by exclusive connection with either of the grand divisions of this army, the aim of this journal will be to indicate a common ground, upon which earnest workers in all can meet in the interest of progress, and to claim for all the meed of recognition which is their due. The editor, John A Hill, who has been for several years connected with the motive power department of the Denver and Rio Grande R. R. as fireman and engineer, with corresponding shop experience, introduces himself upon another page. We bespeak for him the good will and co-operation of all.

Naming Engines.

The old time practice of naming engines is coming into vogue again on some roads that long ago abandoned it as foolish. There is no doubt that the public like the idea, and a hundred people will talk about the feats of the "Quickstep" that would never remember the 194 for four days. For passenger service we believe it pays.

Vreeland's Transfer Jack for Removing and Replacing Locomotive Drivers and Trucks.

It is often desirable or necessary in railroad repair shops to remove a pair of drivers or a truck from under a heavy engine. The usual method is to raise the engine up by four hydraulic or screw jacks, placed under each corner, until the wheel can be rolled out. This required the lifting of the whole machine from fifteen to twenty-four inches. It not only makes the engine too high to work on without staging, but, as the jacks must be used elsewhere, the ponderous boiler is blocked up and left there—a dangerous and unhandy arrangement. Some very large shops have "drop tables" and "steam lifts" to do some of this work, but these are cumbersome, expensive, and occupy valuable floor space.

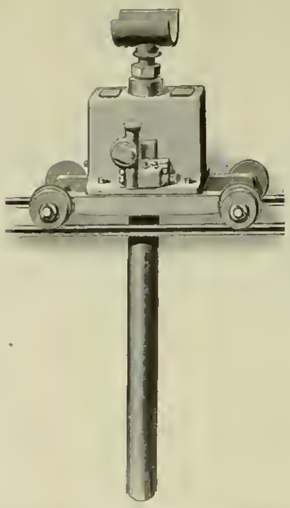


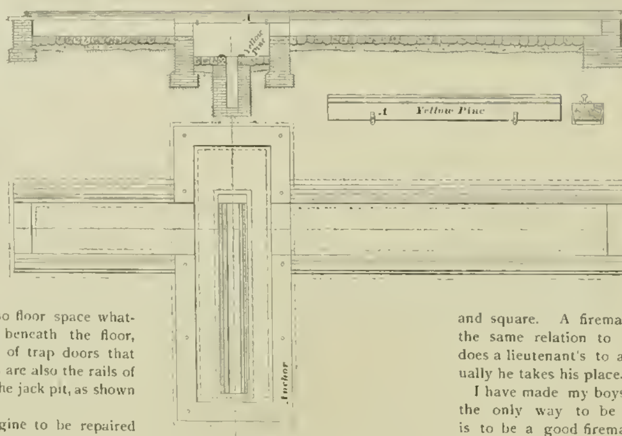
APPLICATION OF TRANSFER JACK.

Endless annoyance of this kind induced J. H Vreeland, master mechanic of the eastern division of the New York, Lake Erie and Western Railroad, to invent and build at his shops in Jersey City the jack here described and illustrated.

By reference to the cut of the tool itself on this page, it will be seen that it is merely a hydraulic jack, mounted on four small wheels, and having a very long ram. The pump is cast separate from the head or frame, and can be removed for repairs if necessary; it is operated by a removable lever, the same as used in the common hydraulic jack. The top of the ram has a curved head in which to rest the center of the driving axle; this is swiveled so that a pair of wheels can be turned around or placed on a track not in line with the track from where they were taken. The ram has a very long bearing at the top of the frame or head. The excellent engraving hardly needs an explanation.

By reference to the cut on the first page, it will be seen that the jack pit runs at right angles to and crosses the regular engine pits. This pit is wide enough to take in the largest engine truck complete, and is about twenty-four inches deeper than the engine pits. In the bottom of the jack pit is a slot about ten inches wide, and deep enough to clear the lower end of the long cylinder. On this page will also be found a ground plan of the pits.





The device occupies no floor space whatever, being entirely beneath the floor, which is in the shape of trap doors that are easily removed, as are also the rails of the engine pits, over the jack pit, as shown at *A* in ground plan.

In operation the engine to be repaired is run over the pit and pinched until the axle or truck-center is exactly over the head of the jack, the engine is left standing at its usual height, no raising being necessary; the jack is then pumped up until the weight of the pair of wheels is lifted, the removable rails are pulled out, and the wheels are dropped down far enough to clear everything, the jack rolled on its own track to an adjoining pit, raised up and the wheels rolled away to the lathe, the turn-table or the scrap heap.

All the shops of the N. Y., L. E. and W. are equipped with this jack, and it is a common occurrence to run an engine into the shop or roundhouse in the morning, after she has made her trip, drop a pair of drivers, refit one or more boxes, and send her out on the afternoon run; meanwhile the fire has not been disturbed or steam blown off. For cleaning out or fitting up main driving boxes, the wheels are often dropped a foot or so without disturbing the eccentric blades at all.

Four men are usually put on this work, two in the pit to do the pumping, and one at each side to steady the load, etc.

At the Jersey City shops four pairs of drivers have been replaced under a consolidation engine in thirty-eight minutes by a gang of four men. Watson & Stillman, of 210 East 43d St., New York, are the manufacturers and sole agents of the inventor.

Fighting Against Nature.

BY JOHN ALEXANDER.

I am a locomotive engineer, or runner, and have been a fireman; I fired for more than four years and have been running for more than eighteen; my oldest boy, Harry, is a fireman. So you can see that I can at least lay claim to a little experience.

When I learned you were going to start a journal solely for engineers, firemen and repair shop men, I was glad; I need it for my boys and I need it for myself. I am one of the few engineers that are perfectly willing that their boys should follow their own calling; my wife is now converted to my belief. I am proud of my occupation and the responsibilites I assume. I cannot think of anything I would care more to hear of one of my sons than for some man, who knew what he was talking about, to say: "That young man is a first-class locomotive engineer."

Enginemen of America, what does that remark mean? To a workingman it means a skilled mechanic, capable of earning from two to four times as much pay as a laborer. To the railway officials of the country, a man in whom they can safely trust the trains and property of the road, safe in his decisions, cool in emergencies and faithful to his trust. To the thinking public, a hero whom it will be perfectly safe to trust with the lives of the dearest ones on earth. To his family it means sobriety, thrift, manhood. To his friends, kindness, benevolence, honesty, honor and a good example. To society, a man and a gentleman, intelligent, grimy-handed and square. A fireman's position bears the same relation to an engineer's as does a lieutenant's to a captain's—eventually he takes his place.

I have made my boys understand that the only way to be a good engineer is to be a good fireman. I have three, and they are all as engine-crazy as I was myself. I made a rule that when they graduated from the city school they could go into the shop as helpers to machinists; then, after serving one year, they could make their choice of occupations. If they still wanted to go on the road, I would help and not discourage them. My father kept me off the road until I was of age just because *he* disliked the business. My second boy is in the shop and the third in school.

Engine running is hard work, calls for muscle as well as brains. So is plowing hard work, driving team, keeping books, clerking, or moulding gum-drops.

The sooner the young men of to-day, who are blessed with that great incentive to work up—poverty—settle this fact in their minds, that to advance hard work is necessary, the better for all.

Men who aspire to be good mechanics must go through several years of hard apprenticeship. There are too many young men who would make good blacksmiths that try to be bookkeepers. They dread the sweat, and their parents are foolish enough to think there is a disgrace in wearing a leather apron at $3 per day, that is not found in a pen behind the ear at $2.50.

If I had a boy that was a natural doctor, liked the study, would rather help cut my leg off than go over the road with me, how foolish I would be to force him to go on to the road as a fireman. Yet how many engineers do this very thing—upside down. A boy that wants to be an engineer will make ten times a better engineer than he will a doctor, and when we use every influence we can to make him what his nature says he is not and cannot be, we simply fight against nature. Nature always wins, or the boy is spoiled. I would rather my boys should be day laborers than botches at any business.

There is another thought that I want to air. Many a boy only thinks he wants to learn a certain trade or business. He may have an eye for machinery and think he must be an engineer; a few trips in the night and storms may show him that he was not intended for an engineer, lacks the nerve, caution or confidence, but he may turn his attention to the machine shop and find his forte. I always gave my boys a chance to look into the details of any business they took the least notice of or interest in, but they have come back to a locomotive just as a lost dog smells out his master.

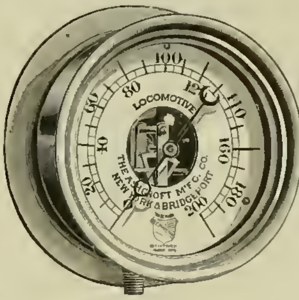
Workingmen, even skilled mechanics, can leave their children little more than sound bodies, a fair education and a good example—and this is enough. Josh Billings was sound when he said: "It would be better for the country if there were more kits of carpenter's tools and less legacies left to our young men."

Locomotive engine running is bound to be a noble, honorable and remunerative calling; it will grow in importance and dignity in the future more than it has in the past. It is bound to be filled by a class of intelligent men, who will be men in every sense of the word. I am proud of my calling and if my boys want to follow in it and excel their father, I am not going to fight against their natures as I know many an engineer is doing to-day.

Improved Steam Gauge.

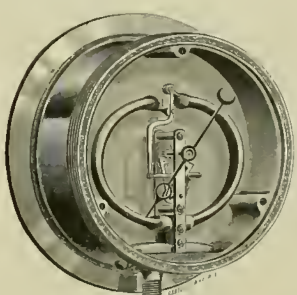
Every man who has watched a steam gauge for any length of time from either side of a locomotive cab knows something about its good and bad points. When an engine has been out for some time and the gauge has leaked, and been fixed; when the glass has been broken out, and the pointer knocked off and replaced by guess, and a few such slight accidents occurred to make him have some doubts as to the gauge's honesty, an engineer does not feel very safe to go and set the "pop" or safety valve by it. Such men know the value of large figures and in having the dial close enough to glass and rim far enough from figures so as not to shadow them at night. They also know what a nuisance it is to have steam from the outside get into gauge and cloud glass and sweat dial, and they know how much worse it is for them to leak internally and thus hide their own face in shame at not being able to tell the truth about the steam pressure.

In the gauge here illustrated no attempt has been made to get up anything particularly new, but to improve and perfect every detail of well-known gauges. In the first place, several thousand dollars were spent in trying to make seamless brass tubes of the proper thickness and shape. This has been accomplished, and avoids the dangerous leaking of these



IMPROVED STEAM GAUGE.

pipes inside the gauge—one great trouble with the brazed tubes. Then the gear and segment were so arranged that, when adjusted to the proper working pressure, all were perpendicular and in line, with no strain from weight of parts, etc. There is no connection to back of gauge at all to be affected by the heat, or twisting of parts if screwed to an uneven surface. All the



IMPROVED STEAM GAUGE.

gear and working parts are supported on the central connection of bent tube; the case merely surrounds it, and is no necessary part of it to insure true results. The gears are cut by watch-making machinery and have wide faces, to prevent wear. Around the gauge casing front is a deep groove holding a heavy ring of felt, on which the glass is pressed by the front or ring, which screws on, thus preventing jars and the breaking of glass by expansion. The dial is cut away in such a manner as to show the entire working parts, which are all finished. The gauge presents an inch larger dial than any other gauge of its size, at back, and the figures are large and very plain. It was especially designed for locomotives, and several hundred of them are already in use. They are manufactured by the Aschroft Manufacturing Co. of 111 Liberty street, this city.

One-Man Locomotives.

In a recent issue of a so-called mechanical paper was one of those little statements that amuse practical railroad men, and at the same time show them how little the writer knows of the actual facts in the case. In an article on the burning of oil as fuel on locomotives, the writer, as usual, went on to enumerate the advantages and the economy of the device, and among other things mentioned that it would reduce the expenses of the fireman's wages. as the engineer could easily control the fire from his seat by simply turning a valve.

There are many reasons why one man will never run a locomotive alone, and they are very plain to any man who "has been there." There are more duties for a fireman than merely shoveling coal. His duties are legion; he has supplies to draw, lamps to fill and clean, the interior of cab to keep clean, the whole engine above the running-board to care for, front end and stack to paint, water to take, bell to ring, etc. These duties cannot be performed by the engineer; his duties, both on and off the road, are as numerous as the fireman's: they cannot be entrusted to roundhouse men, because they cannot know just what is wanted, and it would take as long to explain to them as to do it.

Any engineer who has ever sent his fireman to flag on another train for a few miles and followed with the light engine, knows just how oppressive the lonesomeness gets. It is often necessary for some one to go out in front to relight or turn up a signal lamp or the headlight, put out a flag or dig down some sand. Can the engineer go, and leave the mighty locomotive, with its precious freight, flying along over crossings and bridges, through cuts and towns, with no brain to think, no eye to see, or no hand to stay its mad career in case of sudden emergency? Can the engineer set his engine at a tank, go back to take water, find spout too long or too short, and get down and "jim around" till he does get it right, take water, then oil, get up, ring bell as he wipes off oilcan, go over on fireman's side to see signal, then get back on his own side and pull out? The traveling public would kick, and kick vigorously. The delays would be demoralizing and the risk great. The only legitimate and proper school for engineers would be sealed forever, and, as more engineers would be killed, there would be no skilled men to take their places.

In cases of sudden sickness or death of engineer—suppose he fell off—who is there to stop the train? Who stopped the President's special train, a few months ago, when the engineer was killed by a broken side rod while running at a high rate of speed? The fireman, of course.

The economy of saving the fireman's wages in this case would be like saving the expense of the roof of a powder magazine. The day of one-man locomotives in road service is farther away now than it ever was.

The Roundhouse Foreman.

BY JOHN J. BINGLEY.

There is no position connected with the mechanical department of railroad operations that requires more tact, judgment and energy than that of roundhouse foreman on a large road, especially where the motive power is about half that required to move the freight and passsenger trains over the road, and more so if the rule is, first in first out. I have often seen engineers and firemen waiting from one to five hours with dinner pails in hand for the first engine to come in, and, as is often the case, when they begin to come, they come in a string. The first duty of the engineer is to make out his report of repairs needed; something like this: "Eng. No. 20; R., packing down; R. B. D., spring broke; R. F. E., truck, box runs hot; R., injector don't more than half work, etc." This the roundhouse foreman scans, while the foreman of engines stands at his elbow saying: "How soon can I have that engine? It is time she was down to the yard now. Train dispatcher is calling for engines." Now the roundhouse foreman is in a fix: he knows if the engine goes out, and she should break down on the road, the foreman of engines or the train dispatcher will not be held accountable, but the M. M. will call him to an account as to why the work reported was not done. His standard rule should be, not to let any engine go out that he would not be willing to go on and run himself.

Taking this as his rule, now the ball goes on. He orders Smith and Jones to put a new spring in, and hurry up; and "Brush, you get some oil and waste and pack that truck box, and be lively." Brush starts off muttering something about "it's always lively;" about this time comes the engineer with something he forgot to put on the report, and the foreman of engines wants to know how soon he can have that engine. By this time two or three more engines have come in, with reports made out, and there is pulling on all sides; and, what, with steam pipes blowing, eccentrics running hot, feed pipes leaking, and a hundred other things, our foreman is almost wild; goes round to Smith and Jones and finds the holes in spring are too small for the hanger to go through, and the air is getting blue with the blessings on the spring maker; then the hydraulic jack gets stubborn, and there's lots of (all but) fun.

I tell you the position of roundhouse foreman, if he is a conscientious man, is not a bed of roses, as was told to me some years ago when assuming that position on a trunk line, often having six or seven sections to one train, and going through the repairs on over 400 engines per month. The constant worry and responsibil'ty of a position like this is enough to turn a man's hair gray in a few years.

I desire to offer some few suggestions that may be of use to those in similar situations. In the first place, there must be a good gang of men, and the foreman has it in his power to make them good or bad. He must by his own push and "git," show them that he is the color bearer, and go-ahead, speak words of cheer and encouragement to the men, and give them credit or praise for a good job. Again, he must know his men, and let the same man, or pair, do the same work. For instance, let two men put all the springs in and do all smoke-box work; another gang do all work on passenger engines; another set out packing, file and line up brasses, crossheads, etc.; another do work on injectors, gauge cocks and oilers. By so doing, each set can have the tools suited to their work; the spring gang must keep the jacks in order, have chains, blocks, etc., in their care; the men that pack the oil cellars to have a half barrel of waste and oil soaked ready for use and securely locked up.

Tools are a very important item in roundhouse work, some of which I may describe later on.

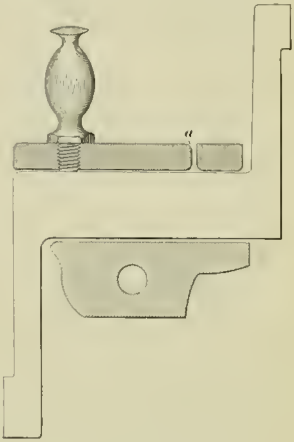
Bad Make-up of Trains.

We recently saw a long heavy freight train leaving an Eastern city, that one good look at would convince any railroad man that the yard men who made it up, the officers who allowed it to go out, or the crew that took it out, ought to be roundly censured. We do not know what was in front, only that the train was made up of all kinds of cars from many roads, the flat car next the caboose was piled high with telegraph poles; these had slid ahead and covered up the brake; the next four cars were loaded with long sections of an iron bridge, reaching over two cars; the brakes had been taken off, all but one, and this was connected to but one truck; the sixth car from rear was an empty gondola, or dump car, with a brake wheel at each end, one for each truck; the seventh, a tall refrigerator. What a man-trap! Suppose six, eight or ten cars should break off the rear of that train when running at any speed above ten miles per hour, and on any grade at all. The weight would make a terrible weapon, and it could scarcely help being shot somewhere. A man could get from way-car to train only by great care over the top-heavy load of poles, and when he got there, what could he do? No brakes to set that amounted to anything. If the train started back on a long grade, Heaven pity the poor fellows on the next train. If the cars broke off and followed the train on a down grade they would surely catch it, and with disastrous results. Here is a great argument for an automatic freight brake. But now, while we risk life, limb, and cash on the old hand brake, let the rear end of all trains be made up of cars with first-class brakes, and let such boomerangs as double loads of iron on brakeless cars be carefully distributed, with good brakes each side of them, and don't put a fortified car in front of caboose to keep men from getting out and over train quickly.

A double glass in your front windows will keep them from clouding or frosting over.

The Fountain Oil Cup.

This is not a new device; it is not patented; you have used it yourself, and you do not like it. The writer used to wonder how he oiled the outside of the rocker boxes, as well as the inside, or better. Take a look at the sketch and you will remember the one you have just like it. If you have a good feeder in the cup, it will let the oil down carefully and lubricated all right; but this cup is not moved like a rod cup and has no chance to get warm and every chance to get cold, so most engineers prefer to let the feeders be very loose, and when the cup is filled it runs down into the box, along the oil slot, and out of the drill hole that the cautious builder has put in the casting as an extra precaution. This extra hole catches dust, cinders, water, sand and several other things not of a lubricating nature. It would, in nine cases out of ten, be better never to have been bored; many engineers plug it up with cold tallow and find it pays.



Simple Glass Gauge Guard.

The breaking of sight feed lubricator glasses generally makes a nasty mess in a cab and the flying pieces of glass have hurt several men very severely. There are guards now made that protect the persons of the men who have to live pretty close to them. Some show the feed on a small mirror, but this is not always a convenient arrangement at night when the glasses are not handy to the gauge lamp, and not every company will buy improvements after once paying for the lubricator. The writer saw a little idea the other day on a N. Y., L. E. & W. engine that seems to fill the bill.

The device was simply a coil spring of brass wire just large enough to slide over the glass tube. This keeps a broken glass from turning into a bombshell; it costs nothing and can be pulled down or up out of the way while the glass is cleaned. Try it.

The Curtis Automatic Pipe Coupling.

Since railroads are putting in steam-heating devices on their trains, one of the stubborn little details has been a good hose coupling between cars, that would not leak, and a great many different kinds have been invented in less than a year. It was found necessary that each coupling should be complete in itself, and all alike; they must lock together firmly, without the use of tools, and unlock automatically should the cars be separated without unlocking them by hand; must be light, and so constructed as to be easily handled by hand when hot.

It would seem that the Curtis Regulator Company, of 59 Beverly street, Boston, have solved the problem in their "Automatic," which consists of the ordinary nipple for rubber hose, with a suitably packed joint, and three strong lugs or clamps to draw the faces together. The locking faces of the clamps are set at a slight angle with the face of the coupling, so that when turned in opposite directions by the levers, the packed surfaces are drawn firmly together, making a steam-tight joint.

Each coupling has a lever, or handle, and each handle has a fluted surface set at right angles to the axis of the coupling, and so adjusted in relation to the face of the coupling that when clamped together the fluted surfaces engage with one another, forming a locking device which holds the two couplings firmly engaged.

On each lever is an eye to which is connected a chain. The chain on each lever is fastened at the other side to the platform of its car, and being shorter than the connecting hose, draws the fluted surfaces past one another and disconnects the coupling before strain comes upon the hose.

It is obvious that these couplings can be handled with comfort, even when hot, by means of the projecting handles, while a sharp pull in opposite directions connects or disconnects them instantly.

The projecting clamps form a complete protection to the face of the coupling against abrasion from outside objects. The cuts need no explanation.

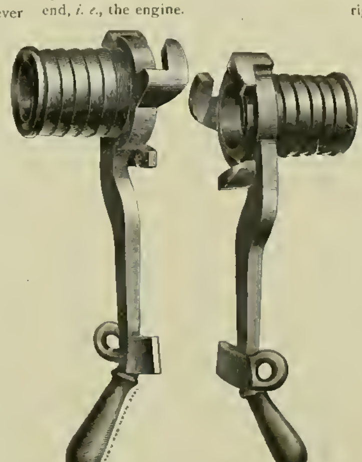
The Car Heating Problem.

The newspapers in the United States that have not published something under the above heading, or one similar to it in the past year are very few indeed. Each and every one of these criterions of the public mind prove one fact, and that is that the people all over the land demand that common stoves shall not be used in the cars. This brings the source of heat down to the locomotive, or a special car for heat only. Now we are not going to settle this matter here—we doubt if it will be settled for some years by anybody—but are going to offer a few suggestions to such inventors, or experimenters, as have had no practical experience on the road.

The greatest, and about the only objection that we have seen to the use of live steam, is the fact that most of our passenger locomotives have had about all they could do to keep up steam enough to pull their trains; the heavier and faster these

THE CURTIS AUTOMATIC PIPE COUPLING.

trains are made the worse this feature is, but this is not the only objection or danger. Statistics show that of all the accidents that railroad trains are heir to, more than 85 per cent. of them happen to the front end, *i. e.*, the engine.



THE CURTIS AUTOMATIC PIPE COUPLING.

Suppose now that an express train on one of our great plains, during a bitter cold night, plunges into a sand drift—they have those things out there—and the engine turns over, knocks off a steam connection and "dies;" it is three or four hours before another train is due, if the storm lets them in on time; if not, they may not come till the following day. Where are you going to get your steam? Suppose you heat by exhaust steam, where is your exhaust? If you heat by exhaust, how are you going to heat your train before you start unless you have a live steam connection? Using either system, how are you going to heat the car you pick up at the small station in the middle of the road? With the exhaust heater you must make provisions for such stops as ten minutes for changing engines, twenty minutes for refreshments, or two hours for a burned bridge.

The arrangement for heating by using very large pipes of salt water heated by steam, either live or exhaust, will keep the car warm for some time after the source of heat is removed, provided there are means used to keep the water from running out of the pipes in case of accident to one or more cars; but it takes longer to heat the car picked up away from home than by the live steam radiator system.

In any experiments you make there are more chances of success if you do not depend upon anything but on the car to be heated. Everything else being equal, this kind of a heater would be the most successful. Do not expect motion from the wheels to generate anything—they are not always in motion when you need heat Do not expect to always find steam in abundance on the locomotive—they are often cold in death. Do not expect that the exhaust of a locomotive is yours to use entirely: it is already choked down to a shrill whistle to force the draft; if you use it, they will have to use live steam to create a draft. Devices that work all right in the shop may be found wanting when put in motion, and some that are a success on time may become cold and dismal failures at a snow blockade.

Some State laws already forbid the use of stoves and prescribe certain kinds of heaters; this is very unjust; there should be no such strict law in any State. Has there been as yet a heating device gotten out that is known, by the severe test of actual use, to be a success? Railroads cannot respect State lines in passenger service without great annoyance and danger to the traveling public. Think of changing cars at every State line from here to San Francisco; through cars are now run from New York to Chicago, Chicago to Denver or Ogden, and from there to the Golden Gate; if each State had a certain heater of its own, no less than eleven changes would occur in that distance.

If laws are a necessity, let them be national ones.

It looks as if, with any system adopted, the stoves and a supply of fuel must be put in the cars to use in an emergency.

There is the iron car system that carries the fire and furnishes heat and light; the compressed gas system that furnishes the same from the baggage cars; the electric scheme, the soda scheme and a dozen other ideas, all having their advantages and their disadvantages, and all trying to solve the problem the best. Do not hamper these busy researches by wild and unreasonable laws, that will only have to be repealed, and we will venture the prophecy that out of the chaos of experimental contrivances will rise up a Phœnix of heat and light that will keep our feet warm in prosperity and not cook us to death in adversity.

The First Questioo.

Since the editor of this paper left the throttle of his engine to come to New York, he has received the following letter:

J. A. Hill: I like your idea of examination of engineers, if they have to be examined, but hope that you will not go too far. All the propositions you have made heretofore have been practical ones, and I believe your examination ideas are the same, but some of the men here seem to think you would give certificates to all who answered the questions; this would let in many men who have not had actual experience, but who were paper engineers. Of course they would fail on the train rights examination. Now I want to ask you one question: What is the first question you would ask a man after getting his name, etc.? I mean one you would stop on, if not properly answered. CHAS. E FLOYD,
St. Louis, Mo. Engineer.

The idea was not to propose a general examination, but if the examination was forced on us by law, to have a board of practical men appointed and practical questions asked. In answer to our correspondent's question, which was by private letter—and we take the liberty of making public—we would say, that in case of a man being examined for promotion, the first question asked, and we should require proof by a note from his M. M., would be: "Have you fired a locomotive on the road for three years or more?" If this could not be answered in the affirmative, the examination would stop, unless the applicant wished to see where he was deficient in the rest of the examination. We do not doubt that there are many men who have fired less than three years, who are better posted than others who have fired more, but there is a certain experience in practice that can be gained in no other way, and is necessary.

Such an examination would not force railroad companies to employ drunkards, or men in other ways not responsible enough to handle engines. The master mechanic could pick his men then as now, with the exception that he would have to pick from examined men, and hence experienced firemen.

Enough is Enough.

The man who invented the remark: "I know when I have got enough," was a benefactor to the human race, if they only knew it. But he should get out another: "I know when I have said enough." Railroad men should think of this; for instance, what is the use of superfluous remarks in an accident report? A few years ago, on a prairie road, the writer was riding on a freight train that passed a station where a red flag had been displayed and blown away by the wind. An extra was to meet the freight at this station, the orders being to hold the freight. A mile from the station we rounded a curve and saw the extra on a straight piece of track *two miles away*. We stopped, sent out a flagman and backed up. The poor operator was half crazed by the break, and the conductor put in his time abusing him. The extra passed without stopping, and after getting orders we went on. The conductor, in his report, said not a word of the blowing away of the flag, but added to the end of his remarks: "It was a very close call for us all, and this operator should be dismissed." The division superintendent was on that extra, and called on the operator the next day, got a frank explanation, was shown that the old depot was arranged with the telegraph office in the rear, and a freight room and waiting room in front of it, and between it and the main track. The operator could not see the flag, and it had blown out of a hole in a post provided for it. The result was, that the superintendent ordered that depot remodeled, and all others like it, and he suspended Mr. Conductor for thirty days "for misrepresentation and attending to duties delegated to officers," and no tears were shed. A plain, truthful statement of facts is what is wanted, without recommendation or comment.

Inspecting Watches.

The inspection of watches of railroad men is the latest official mania that is knocking the color-blind business cold, and is destined to do some real good. The idea is to appoint an inspector in the person of some well-known jeweler, and making it compulsory for all men running trains or engines to have their watches inspected once in three or six months; so far so good. *Fee for inspecting, 50 cents, to be paid by party for whom inspecting is done.* This is where the shoe pinches. Engineers and trainmen have to pay this fee, that amounts to a good round sum when all in. That there is a job in it has been proven in several instances, where reputable jewelers have offered to do the inspecting free for the good will and trade it would naturally bring to them, and have been refused. Engineers or trainmen who have invested from $100 to $200 in a fine watch, and, perhaps, $25 in a fine locomotive clock, feel as if paying fifty cents every few months for the privilege of informing the officers that his timepiece is all right is the last saw-log on the camel's back. If pay is necessary, let the company pay. If they cannot do so, from motives of economy, let them appoint men who would be glad to do the work without an admission fee.

The Oil Fiend.

The saying that a burnt child dreads the fire is no particular excuse for the child to grow up holding a piece of ice on the sore place. And because an engineer has had a world of trouble with hot pins or guides, or eccentrics, or driving boxes, is no particular reason why he should go through life trying to drown every engine he runs in oil. Do you know him? Do you fire for him? Haven't you heard the brakemen cod him about using a sprinkling pot or a pail and a dipper? Wasn't he over to borrow tallow of you last trip, and didn't you see him out on running board pouring it onto pins, guides, etc., and watching the flying parts slap it around and throw it from the stack to the second car in the train? Half of this is carelessness and the other half lack of judgment. Most of these heavy oilers are free-hearted souls, nothing stingy about them, they often break off the end of an oil can spout so it will throw a half inch stream and call it their "free-hearted can," or "general delivery," or "hurry up," and use it on all occasions. Now what is the use of all this? What good is the oil that runs off? It has come to such a pass now that men must figure to be decently economical in oil and more economical of time; every minute counts. Do your careful and heavy oiling before you start on your trip, and afterward only touch up places most likely to need it—the eccentrics, links, guides etc; do it quick and well. How often we see men who have a set rule about oiling, and taking in every hole, at one or two certain stations and oil a little extra at every stop. If they are delayed five miles from their regular oil town they oil there; but no amount of reasoning seems to allow them to pass the regular place without going over the whole machine again. Oiling a locomotive requires some sense and judgment. Young man, study on it a little, and don't be an "oil fiend."

Who Has the Switch Key?

Just what excuse any railroad management can give, if they were disposed to give any, for so carefully keeping firemen from carrying a switch key is more than has ever come to our hearing. Some roads are also too stingy to give the firemen a time card, yet they expect him to know a great many things that he can best learn from the card.

The fireman always has the switch throwing to do, if the engine goes over the road light, and if he loses the engineer's key they are in a fix. Suppose an engineer has a fireman who, in the hurry, puts the key into his pocket and forgets it, goes home and is sick next day so that an extra man takes his place; in the middle of a division a break-down occurs, the engine has to go to the shop "light" and on one side; they make a siding for the fast express, or mail, and find they are keyless. The engineer has his choice of breaking the lock and tying up the switch, or flagging the fast train and borrowing a key and then finding that he has got his old cripple on the dead center; for either offense he will be roundly censured by the very officials who ought to furnish the firemen with keys—as a safety element.

Men in repair shops who are obliged to do lots of work with ratchet drills, will find they feed and work much better if the pivot is placed in the center of a flat spring shaped like a Cupid's bow.

Correspondence

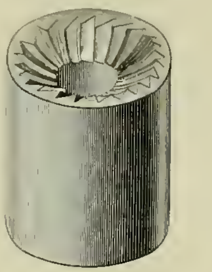
Of course, this being the first number, there is no correspondence to publish, but we expect that each succeeding issue will contain many letters of practical interest to practical men. Little bits of experience related here will interest and aid others. Send yours along.

Who is Best?

Governor Hill, of New York, has followed the example of the Governor of Massachusetts in appointing a locomotive engineer on the board of railroad commissioners. While we have no doubt that Mr. Rickard is a first-class engineer and a man of good judgment and common sense besides, it is to be borne in mind that in a board of only three members, it is impossible to have all the useful qualifications that might be wished for, and that therefore it is important to keep the membership as evenly balanced as possible. In Massachusetts, it is understood that one member must be a lawyer, one a "business man," and one skilled in the art of railroading. The latter expression allows considerable latitude, and Governor Butler, on the expiration of the term of an eminent civil engineer, appointed a locomotive engineer in his place, who has since been reappointed by another governor.

While the qualifications of Mr. Stevens of Massachusetts, or Mr. Rickard of New York, are not to be decided here, it must be observed that an eminent civil engineer is prima facie better qualified for a place of this kind than is an eminent locomotive engineer. It is not without precedent for a locomotive engineer, without previous technical education, to attain high position as a scientific authority, but it is uncommon, and has only been accomplished by means of severe study and intense body-killing application. It is rare indeed that a "self-made" man is not, to a greater or less extent, bigoted. The systematic training, broader cultivation and greater store of actual facts acquired by the civil engineer in his technical school course qualify him, other things being equal, for greater usefulness as a railroad commissioner. But other things never are equal. A member of the Brotherhood of Locomotive Engineers certainly should have sensible views on the relations between railroads and their employes.—*Railroad Gazette.*

In the above statement there are several corners sticking out that a railroad man can hardly help feeling. That railroad commissioners are often called upon to decide vital questions that require intimate knowledge of the real operations of railroading there can be no doubt. When no experienced man is on the board, the commission are obliged to take the statements of railroad officials, or men who there is every reason to believe may have been "fixed." In case of a wreck like Rio or Koutz, who could be better qualified to hear the statements of the engine and train men than an efficient engineer? Would these men dare make a false statement to him? Could any official of the interested railroad make him believe the fault was one place when his years of experience told him it was another? Can as much be said of a civil engineer? In case of a bridge breaking down, a civil engineer might get up a more elaborate report, showing strains, etc., but a locomotive engineer who keeps his eyes open is not easily fooled on bridges either. Railroad commissioners have a great duty to perform in deciding on rates, pools and the financial dealings between the railroads and the public, but they have a greater duty in acting as the public's guardians in matters of life and death, that not only require the learning of the lawyer and the business man, but the practical experience of an eminent man from the ranks of operative railroaders. The last line of the *Gazette's* article makes a very valuable concession. We honestly believe that a first-class locomotive engineer is of vastly more service to the public on the board of any State than any civil engineer, and rest assured that the governors of the two great States will never have cause to regret the appointment of Mr. Stevens or Mr. Rickard. As to the remark about self-made men being bigoted, we would advise the above paper to avoid that expression in illustrating prominent railway officials.



Milling Cutter for Ball Joints.

BY WILLIAM FOSTER.

Having had several years' experience in railroad repair shops, and knowing the wretched condition of the average shop of this kind in its lack of proper tools to do the work with, and the trials that the locomotive repair machinist must undergo from a lack of special or good tools to do his work, I have come to look upon the suggestion of a labor-saving and inexpensive tool or device for such shops and such men as an act of charity.

Some time ago I had a job putting fifty Mack injectors on our engines. I did all the work, bending the pipes as well as all the other work connected with the job. I made a tool for turning up the ball joints, after they were brazed onto the pipe. The old and usual way in most shops is to use a cast-iron socket, turned out on end to the proper shape of the joint to be ground. This is used with oil and sand, or emery, to true up the joint by forcing it onto the work, or the work into it. This is hard work, and takes time.

One day, when plodding along at this kind of toil, and in the absence of the foreman, I cut several creases into the face of this grinder to make it hold the sand and oil. The result surprised me; it cut much faster and a great deal easier. This set me to thinking. I showed it to the foreman, and asked him to let me make a miller, and turn the joints off instead of grinding. He saw the value of it and told me to go ahead and we would try it. I got a piece of good steel, turned it to the right shape, and, not having a milling machine, I spaced off the teeth with a pair of dividers, and chipped out the stock, finishing by scraping, and made a good job of it. This simple little device proved a great success for the work in hand. The old way required thirty minutes of hard work to each joint, and the miller did it easily in two minutes. In repairing locomotives time is often a big consideration. Since then I have made a set of these millers for all sizes of ball joints used on our locomotives, for pumps, injectors, heaters, oil pipes, etc., and no man thinks of grinding in a ball joint in this shop.

During the past seven years that these tools have been used we have had no trouble from leaky joints made by them. I send you blue print of the one we use for injectors; they are simple, cheap, and fill the bill. Shops having milling machines can make them very cheaply—perhaps two dollars each would cover all expense—and I am sure their use for a single year, in any repair shop, would save many times their cost.

The Locomotive Engineers' Monthly Journal is to be turnished free to every member of that order for 1888. This is a move in the right direction. The Journal will contain all lodge information, the death and assessment notices, etc., and should, of right, be a part of the order and placed in the hands of every member, without extra expense, for his proper information. The net proceeds of the Journal for last year created a fund of between nine and ten thousand dollars, which was all devoted to charity at the twenty-fourth annual convention recently held in Chicago. Any man or body of men cannot help but feel better, more independent and more secure, if they know they can help their friends and themselves, of their own bounty, regardless of outside influences; therefore there is a proud feeling among the engineers in particular, and workingmen in general, over the report of the grand officers of the B. of L. E., that in the past year that institution paid out to widows and orphans the handsome sum of two hundred and fifty-nine thousand five hundred dollars ($259,500), making a total of two million two hundred and forty four thousand six hundred and sixty-nine dollars and sixty-one cents ($2,244,669 61) that has been paid since the association was established in December, 1867.

This shows what men can do for themselves if they but try. This magnificent sum was all collected by small monthly assessments on members who were thus protecting themselves and families against want in case of disability or death. By furnishing the Journal to every member, and discontinuing the practice of issuing lodge circulars and notices, and publishing same in the Journal, every member can keep posted on every detail, whether he lives in a town where a division is located or not. We believe the new rule will materially lessen the list of expulsions for non-payment of dues and assessments, half the time caused by absence or forgetfulness.

The Work Book.

BY H. R. JONES.

Don't be anxious to put your name on the work book at the end of every trip.

It is not necessary, in order to be considered a good engineer, to display your knowledge of the various parts of your engine by covering a page with a long list of stuff about what is or is not the matter with your "right go-ahead eccentric strap bolt nut," or the "cap to the left back journal-box of the forward truck under tank." Of course it is your duty to report all the work that is *necessary*, but be sure that you know just what *is* necessary before reporting any exact thing to be done to any part of your engine. Don't report a valve as "blowing" and needing to be faced, when *perhaps* the trouble is in the packing. Such a report entails several hours of unnecessary work, besides the shop wear of taking the valve out and replacing it again. This shop wear is frequently the source of more expense than all the wear and tear on the road. Perhaps a nut or two has to be split, a stud is broken or thread stripped and a score of little hindrances that are quite likely to occur, as any machinist can testify.

Observe carefully the working of your engine, and report the repairs when you are certain they are needed. Leave a good deal to the judgment of the foreman or the machinist who is to do the work. Tell him the symptoms of the disorder rather than the exact disease.

Don't be too sure about the location of a pound. Nothing is harder to locate exactly.

Don't give yourself away by reporting the side-rod brasses pounding, so as to break the glass in the cab windows, on the first trip after she is out of the shop and has had a full set of new brasses all around.

Don't call the foreman out to watch the lost motion in the driving boxes and wedges, when he can't so much as see the grease wink while you thump her.

In short, remember that while it is true that "a stitch in time saves nine," it is frequently best to "let well enough alone."

There are two kinds of wear. One is that due to the natural friction of the parts as they work together; for instance, the brasses on their pins, cross-heads in their guides, piston rods, valves, packing, etc. The other is that due to a bolt or nut working loose, a frame working in a splice or joint, or brasses loose in their straps.

The first of these kinds of wear is expected and provided for in the design, and may go on for some time and to a considerable extent, without material injury to the working qualities of the engine.

The second is not expected or provided for, and when discovered should receive prompt attention.

Do not allow bolts, nuts, keys or set screws to run loose. Here is where a "stitch in time" comes in good play. Do it yourself, and so save a charge against your engine.

A loose brass in a strap is many times worse than an eighth of an inch wear on the pin of a side rod.

Oiling Wedges.

How many engineers have had trouble with the poor oiling arrangements on the top of wedges and shoes. They remind one of a hog trough with both ends out. There is generally a little corner chipped out of the top of driving box next to wedge and shoe, and this is often carried around the wings or projections on box, so that the oil is carefully ditched off and carried down to the ground *via* the frame, just as a farmer would scheme to drain a muck swamp of stagnant water. Why would it not be better to tap a good-sized hole through from oil pocket on top of box to the wedge and shoe? It would be under the waste, and not be full of cinders half the time, as the present endless trough is Wedges without oil soon cut and cause the engine to ride hard and prevent keeping the wedges properly set up. Our experience with sheet metal covers for driving boxes is that they catch and carry dust, sand and cinders away from the oil pocket, but onto the top of wedges and shoes. Waste above and covering tops of these exposed and important parts of the locomotive is better. It should be changed as soon as it gets dirty, without disturbing the lower layer of wool that feeds the journal itself.

Inventing New Devices For Locomotives.

When any man attempts to improve any existing kind of machinery he should first make himself thoroughly acquainted with the machines in use as well as with every detail of their use. How few men do this who attempt to improve the locomotive. The devices that engineers are asked to try, that are entirely impracticable, are legion. Many an engineer has seen where he could improve on some part of an engine, but something, perhaps modesty, kept him back. Not so with the genius who has got a new notion in his head about some change or other. He deliberately sets up posts and rods close to track to catch some hook he is going to put on engine that will turn some distant signal or ring a bell, or set the brake, regardless of how many heads it will take off besides. He puts a smoke-consuming device in the stack to eat smoke that eats most of the draft, some smoke, and sends the rest out of the ash pan to deaden the glare of the varnish on the cab. He puts a patent damper on engine that stands proudly up in the center of the deck and reminds the fireman that it is there at every turn. He puts a device on top of dome to save the steam wasted at the pop, and proposes to return its heat to boiler, and generally succeeds in getting everything else too hot to work—including the engineer. He gets out a new valve motion that does the work about as well as the link and perhaps a little better, but at the cost of twice as many parts, cost and wear. He gets up a self-closing glass gauge-cock that don't close. He invents a boiler compound that prevents scale from forming, and also soaks the form of steam so you can't drag it through the cylinders. He invents a 1,000-mile dope that will help the journals to melt in half that distance. He invents a side-shoot pilot that will throw a yearling bull over into a ten-acre field and not hurt him, but it throws a man into a wire fence. He invents a fire-box and stack that keeps cinders out of the car windows and don't let the water in boiler get hot enough to shave with. He puts a snow flanger under the pilot that comes off and ditches the engine. He invents a steam bell ringer that will keep you from ringing the bell all summer and freezes up and wont let you ring it in winter—or won't ring it for you. And thus the improvers keep nagging away; once in a great while they hit it, but the rest of the time they hit something or somebody else. Many of the parts and appliances of locomotives are crude and unhandy, but the principles are all right and only want the details carefully considered and improved to make them all that can be hoped for.

The "Do Not" Order.

On a great many single-track roads the use of the form of train order known to road men as the "do not," is being tabooed, as it deserves. This order has caused some very bad wrecks, and lost many a good engineer and conductor his position. The order is generally given not to pass a certain station, perhaps fifty or seventy-five miles away, because the dispatcher has a work train beyond there, or expects a special to leave the other end of the road sometime. Often this order is received, and then three to ten others are added to it before the station named is reached, and in the interim the "do not" is forgotten by all concerned, even the dispatcher. Any dispatcher who gives this order and does not order the signal for orders displayed, and kept displayed, at the station named in the order, should be dismissed; it should be used only in emergency, and with all the caution possible. Engineers have enough to worry over without the "do not."

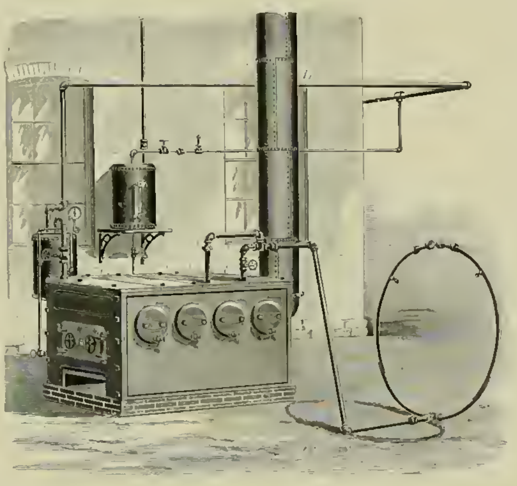
Headlight Wicks.

A young engineer was recently heard to remark: "I ran an engine over two years before I knew how to turn up the head light." Had this remark been ventured in any other than a railroad crowd, the speaker would doubtless have been considered a mighty poor excuse for an engineer, but the boys knew he was first-class and let him finish. "You see a wick is made of several wraps of Canton flannel, and it has to slide over one tube and inside another, and if one or both get a little rough, the wick sticks in being forced up and 'wrinkles;' when the engine gets to pounding over the road the wick works up and the headlight smokes without any seeming excuse. Now I just turn mine up too high, then down to where I want it, this straightens the cloth out and it works all right."

Apparatus for Heating, Setting and Removing Locomotive Tires.

A very complete arrangement for putting on new tires, or taking off old ones. It will do all the work connected with tire heating, setting, removing, shimming and replacing. In case of a loose tire, it is not necessary to take down the connections. In taking off or putting on new tires the connections are taken down. In all cases the engine is jacked up so that the wheels will clear the rails about two and one-half inches, to allow the burning hoop to be placed around the tire. This hoop is not a continuous ring of pipe; the ends are plugged up and are left a little space apart, so they can be placed on the wheels while the connections remain on them and small studs are placed in hoop to hold it off from the tire at a proper distance. The machine consists of a furnace or generator in which are four cast-iron retorts, three of them for making the gas, the other one for heating the air that is used with the gas; allowances are made in the construction of the furnace for contraction and expansion. In addition to this generator is an oil reservoir for holding common kerosene oil; an air reservoir, a gauge for registering the air pressure, a needle-pointed valve for regulating the flow of oil, and an injector arrangement for forming and mixing gas and air for burning in the hoop around the tire. The operation of it is very simple. After the oil reservoir is filled and the oil cocks shut off so that no oil will enter the retorts, build a fire in furnace with any fuel desired; in about half an hour the retorts will be hot enough to make gas; then place the burning hoop around the tire, connecting it to the connection containing the injector arrangement; start up the air pump until there is an air pressure of from 15 to 40 lbs.; open the needle pointed valve very little, until a very rich gas like smoke escapes through the holes of the burning hoop; then open the air cock to allow air to mingle with the gas and when a proper mixture is made, apply a torch, and an intensely hot and blue flame will strike the tire, penetrating it very quickly. As very little oil is required, a fine thread screw is made on needle valve, so that it is very sensitive. The device can all be mounted on a push car if desired, or arranged stationary. The gas is made only as fast as used, and as there is no accumulation there is no danger from explosion, and no waste. When the tire is hot enough, shut off the supply of oil with needle-point valve, the flame stops, also the generator. A 4½ ft. and a 5 ft. burning hoop are furnished with each machine. At the regular standard of shrinkage, tires can be taken off or put on in from four to ten minutes each. The cut shows the plant as erected at West Philadelphia shops of Pennsylvania Railroad Company. It is made by Pedrick & Ayer, 1025 Hamilton St., Philadelphia, Pa. We quote from their description.

Next month we shall give the result of some tests recently made at the Pennsylvania Railway shops with this device.



That Flat Driver Engine.

There is at present a locomotive at Boston, built for the Swinerton Locomotive Driving Company, who, to say the least, make some odd claims. The engine has but one pair of driving wheels, and the face of tire, instead of being round, has 105 flat surfaces or facets. The inventor, or the company that have the stock, claim that by having these flat places the tire has a "bite" of full two inches on the rail, and that by thus increasing the surface of the point of contact the engine will be able to do wonders, "will run up hill as fast as down," and, "having no *side bars* between wheels, can run around curves at full speed, where the present locomotives have to reduce speed to about fifteen miles per hour," and a thousand other extravagant claims, evidently written and conceived by men with no practical experience whatever. They say a round driver rests upon the rail only in a mathematical line; according to this reasoning their driver, in changing from one facet to another, will hardly rest on the rail at all. They say that many locomotives are now built with from four to ten drivers, in order to increase the surface of contact, and thus the tractive power; nothing could be farther from the truth. It is a well-known and proven law in mechanics that *weight* determines the amount of *adhesion*, and the adhesion the amount of *tractive* force the locomotive will be able to exert. Broadly speaking, if you put a weight of 1,000 pounds on a board four inches square, it will require as much force to move it as it would the same weight on a board forty inches square, and no more. All the weight of a locomotive would be placed on one pair of wheels if they could be made heavy enough to stand it and the track and bridges could be so used without great injury. Locomotives have more or less drivers to distribute their weight, over some length of track, not to increase the surface of contact. "One of the boys" who has ever rode an engine with one flat spot on her tire as big as a dollar, can easily think of many little inconveniences on an engine with 105 flat spots.

An Air Brake Suggestion.

While there are hundreds of engineers who are handling the Westinghouse automatic brake every day, and doing it successfully, there are few who can explain the action of the valves. They know how the brake works under all conditions, but not *why*. That it would be better for them to know no one can doubt. Men are but grown-up children, and object lessons the better way to teach them. It would pay every railroad using this brake, or the manufacturers, to keep on exhibition at all division headquarters a triple valve and an engineer's brake valve, with the cases so cut away that the action of every working part would be exposed. Engineers and firemen would study it, argue over it, and learn more of the brake than they could out of all the books that were ever written on the subject.

Some years ago the Westinghouse Company presented a lodge of locomotive firemen in Colorado a set of these sectional valves to use in their discussions in the lodge room. Those sections have done missionary work. An old-time engineer remarked to the writer, who was a member of the lodge, that he had handled that brake ever since it was invented, but really never did understand its action till he saw that model then he could not help himself.

The Grant Locomotive Works are just getting in shape again after their disastrous fire. They only built fifty-four new engines during 1887, and there are 1,752 of these splendid locomotives now running.

* * *

The Baldwin Locomotive Works built 650 engines during 1887, the largest number yet. This makes a total of 8,969 locomotives turned out by this concern. They are in every quarter of the globe where locomotives run, and carry the stars and stripes with honor in countries where our ships of war were never seen. This is the largest works of the kind in the world.

* * *

The Schenectady Locomotive Works built 247 engines during 1887, making a total of 2,474 produced by this company. The "McQueens" have one of the best passenger engine records on earth.

* * *

The Portland Locomotive Works built twenty-five engines during 1887. Their works build many engines for ocean-going steamers.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

All communications relating to the business of this paper (except subscriptions) should be addressed.

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

☞ *Mailing address of Subscribers can be changed at any time. Both old and new address should be stated. Prompt notice should be given whenever papers miscarry.*

NEW YORK, JANUARY, 1888.

CONTENTS

Salutatory.

THE LOCOMOTIVE ENGINEER will not be a social paper in any sense of the word. It is not the official organ of any association or organization, and does not expect or intend in any way to infringe on the rights or clash with the interests of the two excellent organs of the Brotherhoods—the finest examples of organized labor on earth.

We believe there is a field for, and a desire on the part of engineers, firemen and repair shop employes to see a journal devoted entirely to their interests in a mechanical way, and recognizing the fact that roundhouse men and firemen are silent partners in the great responsibility and honor of the successful handling of the millions of money and hundreds of thousands of lives that are daily entrusted to the ability, courage and honor of the locomotive engineers of the country.

It should show up and illustrate new shop kinks and new ideas and devices connected with and auxiliary to the locomotive, and keep track of the odds and ends of interest to operative railroad men. This place we shall try to fill.

Correspondence is solicited from engineers, firemen or shop employes, written in plain language that any one with a common-school education can understand—that is the way we intend to write ourselves.

This paper is not published in the interest of any particular manufacturer, machine or device. It will not publish any "catch" advertisements in its reading columns under any circumstances. It will advertise nothing but such articles as pertain to the various branches of locomotive service; no patent medicine or similar advertisements will be accepted. It will not accept passes from any railroad, or meal tickets from any eating-house; but is untrammeled, independent, and devoted to the interests of the enginemen of America.

When we say we shall try to represent the interests of the enginemen of America, we do not mean that we shall always champion the acts of these men, "right or wrong." We believe that in pointing out the fallacy, inconsistency or unsoundness of a belief or movement, we are serving the best interests of the men entertaining or inclining to such beliefs.

It is the purpose and intention to make this journal a practical paper for practical men in its special line. With this in view, the higher mathematics will be avoided the 'ologies and 'isms left to scientific journals, and practical locomotive maintenance and running discussed by practical men.

To "raise the grade" of this class of men will be the first great aim of this journal. Among its special aims it will advocate the following: Men of recognized intelligence for firemen first; opportunity and means of study and improvement next; then ample experience as firemen before promotion, as well as skilled men on locomotive repairs, and shop promotion on merit; locomotive running recognized as skilled labor of a high order, and paid as such; no examination for engineers on rules or time cards which superintendents cannot pass themselves, and no examinations as to the locomotive, for color blindness, etc., except practical ones actually made on the road.

We shall try to represent the interests of the class of readers we attempt to reach, and in demanding justice to them shall try to render justice to all others. We believe in organized labor—for *defense*, not *defiance*.

The editor selected for THE LOCOMOTIVE ENGINEER is not a graduate of any school of technology; he is not a mechanical engineer, a master mechanic or a machinist; he did not run the first locomotive in America and every kind made since—the first engine was probably worn out before he was born; he was a fireman for some years, and has been an engineer for several more; he did not run before the war or the day of lubricators and injectors, but left the throttle of a locomotive to accept his present position. He hopes and expects, as one of themselves, that the engineers, firemen and repair shop men of America will enter into the discussion of practical subjects in this paper with all the freedom they would enter into an argument in the roundhouse.

Reform Needed.

There is one railroad evil that, as far as has come to our notice, is as prevalent in one part of the country as another, and there seems to be a dislike on the part of railroad officials to remedy it, as well as of the men interested to ask a remedy. We refer to the terrible suspense and fear that the wives, mothers and daughters of engineers and firemen must stand after the report of a wreck on the road before they know positively whether their near and dear ones are injured or not. Reports of wrecks spread like fire in a railroad community, and they find delicate women in all ages and conditions of life. A report that the "morning passenger train was in the ditch" throws two, four or six families into a fever of suspense, as there are two or three passenger trains going out, and as many coming in before noon, and wreck reports do not, as a rule, get any smaller by being retold, and each wife or mother is half crazed by a terrible fear, always smouldering, that is thus suddenly fanned into flame by the near possibility or probability of fatal misfortune to some man always uppermost in their minds. There are several thousand women in this country that are called upon to undergo this trial from one to a dozen times a year. It is as cruel and unjust as it is unnecessary. There are plenty of easy remedies. One would be to send word at once to every family whose folks were out on the road that there had been a wreck, but the father, husband or brother was not in it; or make a rule that the family of the killed or injured alone should be informed, *at once, and all the truth told.* But this does not happen often enough to make it any burden for a company to send word to all the families, and say just who was hurt or killed, if any, so that kind friends could gather at the afflicted home and take some of the care off the less fortunate ones. Railroad men, as a rule, do not take as much notice of these facts as their families do, and we venture the assertion that the latter would welcome any set rule that would not keep them in suspense a moment longer than necessary.

The Coming Man.

There are a great many men in the world, ordinarily sharp business men too, who underestimate the influence of workmen in the shops and on the road. There are generals who underestimate the bravery, intelligence and soldierly qualities of many a man beneath his rank, who will, by the rule of the survival of the fittest, or better, the promotion of the worthy and deserving, wear the shoulder-straps of commands in future strifes, and all of us, we fear, forget in our pride that there are but a few years before the boys of to-day will be the young men who will excel us in all things to-morrow, and when they are our age, look back at our records and call us "old fogies."

Some of the greatest successes held up as models to the world were not built with the hope of pleasing the men of the day, but the youth. A few years and they are men and women; they remember these pleasures of their childhood, they are treasured in their homes and furnished to their children. How many men of their time bought and read Defoe's Robinson Crusoe, or Swift's Gulliver's Travels? How many wives and mothers bought and read Alice in Wonderland? Very few indeed. They were not written for men and women, but they are now known and loved, and bought by men and women for their children, because in youth they learned to like them and be interested in them.

The writers ignored the men and women of the day, and sought only the coming men and women. This generation of men and women came, and their children have come, and the children's books mentioned are as familiar to thousands of men with silvery hair as the ablest efforts of advanced thinkers addressed to men of mature age.

It is no new thing to say and prove that many men now in the ranks of the great railroad army will in time become its officers and directors. Engineers will be master mechanics and superintendents of machinery, foremen of shops and roundhouses and traveling engineers just as surely as your son must inherit your name.

This is not all; the engineers are the responsible parties of any railroad; it is the man at the throttle who takes your life in charge when you go away from home, not the man who takes up your ticket. Knowing this, officers, especially those who have come up from the ranks, take a great deal of advice from the engineers; oil that they condemn as no good is not purchased; coal that they say will not make steam is seldom paid for. The writer remembers, but a few years ago, when a large road changed the make of injectors, because the engineers wanted a certain kind that they understood and liked, yet both manufacturers claim that their instruments are "the best boiler feeders on earth." There is not a master mechanic, foreman or engineer who cannot recall a similar instance, or dozens of them.

The engineers will become officers as boys become men, only it is a matter of a few years instead of half a lifetime.

Manufacturers who are anxious to introduce new injectors, lubricators, headlights, oils, or even locomotives themselves, cannot do better than to bring their devices prominently before the working engineer. He is now approachable; when he is promoted he may not be. He will have a thousand cares, and will be more than likely to buy machinery and supplies of parties that he knows by reputation or personal contact. Make your tests with him, and bring your proofs to his notice. He will impress their good qualities on his officers, and don't forget that he is the "coming man!"

Our First Contributors.

On another page will be found a communication from the pen of H. R. Jones, a mechanic of recognized ability, who has come up by his own efforts. He was for seventeen years connected with the Northwestern Railway shops at Clinton, Iowa, serving in every capacity from apprentice boy up. On the establishment of the repair shops of the D. & R. G. Railway at Pueblo, Mr Jones became foreman, a position he held until a few months ago, when he was selected to take charge of the mechanical department of the great smelting works at Pueblo, Col. Few men have had more experience in locomotive repairs than he.

* * *

John J. Bingley, whose name will be found under a good article, was for many years master mechanic of the Hanover & Gettysburg Railroad, afterwards holding an important mechanical position on the Chesapeake & Ohio Railway, and is now head of a department for the Eames Vacuum Brake Co. Mr. Bingley has come up from the ranks, and was in active service before the birth of many prominent railroad men of the day.

* * *

John Alexander is a prominent engineer, pulling a fast mail train in and out of one of our Eastern cities. He has held several positions of trust, but always gave them up to go back to his locomotive. He is a modest man, and in reply to our note for a brief biography of himself, replied: "I am an engineer, and am glad of it; was forty-seven years old last Saturday; have a good constitution, a better wife and four fair to middling children. Let me be known only as a correspondent to your readers, and as plain old John Alexander to my personal friends. You shall hear from me again," which promise we feel sure he will keep.

William Foster is one of that small army of mechanics who have devoted themselves to the special business of locomotive repairs, and carefully studied every detail of it. He is now, as for many years past, in charge of the tool room and the making of tools at the shops of the Providence and Worcester Railway, at Valley Falls, R. I. This is acknowledged by mechanics who have seen it to be one of the most complete and efficient tool departments kept by any railroad in this country.

Why Machinery Advertisements are Read.

A man seeking for new points about machinery, can hardly do better than to read the advertisements of mechanical papers. This class of advertising is always up to date, fresh and complete, shows every improvement and presents every argument showing the superiority of this or that class of machines or tools. There is a fund of information that can be gleaned from advertising that can be obtained in no other way.

A Locomotive Engineer Becomes Railroad Commissioner.

Plenty of locomotive engineers have left the throttle to run the mechanical and executive departments of railroads. The Governor of New York, therefore, in making Michael Rickard, of the New York Central, a Railroad Commissioner, is only following a good line of precedents. Our gubernatorial namesake knows that the man who can handle a frisky locomotive successfully ought to be able to run a stateful of railroads, as a matter of course.

The *Firemen's Magazine* comes to us twelve years old and handsomely enlarged; it is the official organ of the Brotherhood of Locomotive Firemen, an organization of upwards of 18,000 men; is under the editorial management of Eugene V. Debs, one of the ablest young men of America; and withal a journal of such purity and manliness that any body of men might well feel proud of it. Long may it live to carry the grand motto of the grand organization it represents: "Benevolence, Sobriety and Industry."

ASKED & ANSWERED.

Under this heading we hope to make an interesting column, and invite railroad men to ask questions and send answers. We desire, however, that this column be used to get practical information or give it, and not to propound questions that have no practical use, but only remotely bear on the locomotive. It will be of far more benefit to the fireman, for example, to ask questions about combustion, stack drafts, arrangements of the front end and draught pipes, compounds for cleaning, etc., than to dive into the mysteries of designing valve motion. Let the firemen and engineers, shop and roundhouse men ask us practical questions concerning the running, firing, repairing or rebuilding of locomotives, and we shall be glad to answer them. The editor of THE LOCOMOTIVE ENGINEER is not an encyclopedia of all this information, but New York is a very large village, and such questions as we cannot answer ourselves, we shall make it our duty to get answered by the best talent in that particular line. Asking questions is one of the best, if not the best way of getting information.

IN THE ROUNDHOUSE AND REPAIR SHOP.

Consolidation locomotives and others having the boiler extended through the cab, are now being built with the throttle gland in end of boiler same as an eight-wheeler, and connected by suitable levers over the end and on top to throttle lever, instead of piping the throttle stem to the dome.

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The application of steam heating to cars goes on very rapidly. Many different kinds are being tried and adopted, many of which will have to go to the wall after a few years of trial, to give place to some standard that will come up out of the experience of all—much as the M. C. B. car axle and the promised coupler have come.

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One of the handiest things we have seen lately is a block on wheels to put under engines being rebuilt or repaired; some of them have four wheels, others only two. It is very often desirable to move an engine ahead or back, after her wheels have been removed; this can be easily done when the blocking rests on a pair of small heavy wheels. For instance, to take out all the wheels and front truck with the excellent jack shown in this paper, these blocks are an excellent auxiliary, and are far ahead of the old timber blocks. With these blocks a locomotive can be run into the back shop, entirely stripped, and the boiler run out and into the boiler shop without lifting, loading or unloading.

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It is a matter of some surprise that so many very old men, Chinamen, illiterate men and cripples are employed as wipers and machinists' helpers about railroad shops, especially roundhouses. That these jobs should be mainly held by young men who are being examined as to their proficiency to become firemen, and eventually engineers, there is no doubt. But roundhouse foremen get tired of being asked every few days for a chance to go out firing and the result is that they are glad to pick up these men who know there is no future in their jobs. Then when a fireman must be *made*, they get hold of some strong and ignorant young laborer about the yard. Often the one who generally has a cigar sticking out of his pocket when the foreman is near draws the prize. This thing is worse than it should be, and more of it is going on than many people think.

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A look at many, we may say most, of the steps on locomotives and tenders throughout the country shows a poor lot of contrivances. These are handy enough in the shop, where they were made, but no good on the road, where they are used; in all shapes, of all materials, in all kinds of places, they are small, slippery and dangerous. The best plan for a tender step is a broad, long step of wood, closed up at the back and ends to prevent the foot from going through or off, and opening enough to let the water and dirt run through. Engine steps are not always necessary, but the hand-holds of the tank and cab should be large, smooth and strong, and not given to any gewgaw or dragon designs. Life and limb depend on their being handy and practical—more than can be said of many now in use.

On a cold, windy day, when a car door is opened there is a rush of cold air under the seats that sends a cold chill over everyone. This is especially aggravating since the trains are heated (?) by steam. Why would it not be a good idea to have a tight partition under each seat to prevent this?

***

The Rhode Island Locomotive Works, Providence, R. I., are very busy on a lot of heavy locomotives for Georgia and some for Minnesota, and are also building fifty-six engines of the Forney type for the Brooklyn elevated lines. These engines have every known improvement and comfort for the men handling them, and are provided with the American steam and Eames vacuum brakes. The works are putting in three large steam hammers, one each of 1500, 2500 and 4500 pounds; also, a cylinder shaping machine. At present, 1100 men are employed, and prospects are good for a busy year.

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On many roads using the pony truck, on consolidation or mogul engines, the breaking of the large bolt or hanger that goes through the center pin and is attached to the front end of the long equalizer, is a great annoyance on the road. The engine has to be jacked up and blocked to keep this end from cutting into the truck axle. The Grant engines have the fulcrum casting under cylinders made with a hole about the size of a coupling pin, just ahead of the fulcrum pin; by jacking up until a car-pin can be inserted no other blocking is necessary. H. R. Jones, of Pueblo, Col., while foreman of the Rio Grande shops there, bored a large hole in the cast center pin and fixed the eye of the bolt so that an "extra" bolt could be put in on the road in a very few minutes, the engine needing no further repairs at the roundhouse.

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The Taunton Locomotive Manufacturing Company are busy building a number of engines for the Lake Shore & Michigan Southern Railway. The plans being furnished by the road, the engines are peculiar as having the cylinders cast separate from the saddles, being bolted together, and having the steam pipe connected directly to the chest on the side toward arch. They are provided with Hudson's bell-ringer, a very simple device connected directly to the bell bracket. The engines have the flat front ends with the small door, not very handsome. The boilers are covered with asbestos cloth under ordinary wood lagging. These engines have a great many parts made to standard patterns of this road, and are all right at home, but the writer could not help thinking it would be best for the works to brand them "Made to Order," or something like it, to keep railroad men from saying: "Why, a Taunton engine has this or that; that is old-fashioned," when in reality, the company's own engines are models of beauty and convenience. This shop is being enlarged by a substantial two story brick building, to accommodate the rapidly increasing business of building the Huber printing press. There was in the shop for some changes a Forney engine of large size running on some short line about the city. This engine has two Sellers injectors on the right side of cab, both checks being also on the right side, and the air pump on the left. This shop has got ready for a rush in the past dull times, and new tools are to be seen on every hand. The entire works are provided with overhead tracks, lifts, etc, making the handling of heavy parts an easy matter.

One of the old style shops of the past generation can be seen at the repair shops, or shed, of the Fitchburg road at Troy, N. Y. The engines run through the main shed to get to turntable; on one side, in a sort of lean-to with open arches, are the lathes, planers, drills, etc., and on the other side the blacksmith shop and office. There is a side-track in main shed where cripples are repaired. The whole thing reminds one of the sheds of some of the poorer roads of England.

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T. B Purvis, master mechanic of the Boston & Albany shops at East Albany, N. Y., has devised an extension cab for consolidation engines. This device is an extra section of cab roof, about six feet long, lying on top of the cab proper, and connected to it by three coil springs so arranged as to keep it in a certain position on straight track and allow it considerable freedom on curves. To the back of each side of this roof there is a heavy canvas curtain, fastened between the roof and the sides of tank, back of the oil and clothes boxes. There are also sliding side curtains for each gangway, making the fireman's house about as large as the engineer's. The scheme is very popular with the boys who ride the new consolidators, with nine foot fire boxes and cylinders 20x26.

***

The repair shops of the Delaware & Hudson Canal Co., at Salem, N. Y., have little to do now as compared to former years. The place is exceptionally clean and well kept, all machine tools are painted and striped, and everything seems to have a place and be there. The roundhouse is of the old-fashioned type, entirely enclosed, and as the pilots stick over the turntable pit, and the back draw heads are against outside of house, the only way to get around is to climb through the gangways. The table should be covered to a complete circle. We noticed a machinist turning the tire of a five-foot wheel on a common lathe of huge swing. There are very fine wood shops here, but they have been idle for some years. There was one engine in the shop, and those out look well and are nicely painted. Fred. Kegler has been master mechanic here for many years, and takes pride in the thorough and neat work turned out. This branch of the road still uses the old chair iron.

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At the Mason Locomotive Works, at Taunton, Mass, they are building a series of engines for the South Atlantic & Ohio that are an improvement on the original Mason-Farlie that attracted so much attention some years ago. The original engine was a tank locomotive, using the Walschaert valve gear and the tumbling shaft on top of boiler, the engine being a truck in itself, independent of the boiler, and connected to it by a flexible steam pipe. The improved engine uses the Stephenson link and eccentrics; the reversing gear is obliged to be somewhat on the ball joint order to allow for the movement of engine under boiler, and is extra strong. There is a single truck in front of engine that is rigidly attached to engine frame; there is an arch turned over this truck axle its entire length, and carrying the brasses in each end, over its center an immense hook, solid with frame of engine, holds it down, and yet allows one wheel to raise above the other on uneven track, the object being to take the wear off the flanges of the forward driving wheels. The engines are also provided with a sight feed lubricator with a single glass, and feeding into the flexible steam pipe under the boiler. The engines show extra nice work.

A POPULAR PAPER FOR PRACTICAL RAILROAD MEN.

THE PRESENT ISSUE BEGINS THE PUBLICATION OF

THE LOCOMOTIVE ENGINEER.

A new monthly journal devoted to the interests of Locomotive Engineers and Firemen, and to Locomotive Maintenance and Repairs. Examination of its reading columns will show that its aim is to be practical, popular and original. It addresses itself directly and primarily to the great body of working enginemen and roundhouse and repair shop employes, who, from their intimate connection with the locomotive and the appliances and materials involved in its successful operation and maintenance, wield collectively and individually an enormous influence in their field of labor, standing, as they do, in the direct line of promotion to the places of mechanical and executive control.

HOW MANUFACTURERS REGARD THE NEW JOURNAL:

Like its reading columns, its advertising pages are genuine. The too-prevalent plan of filling up the advertising pages of a first issue, and sometimes of succeeding issues, with borrowed, unauthorized or bogus advertisements, intended only for purposes of deception, has not been resorted to, nor will it be in the future. A large part of the advertising orders already received are upon yearly contract, affording ample evidence that the manufacturers of railroad specialties value the good will and co-operation of American enginemen.

An order received by mail from a Philadelphia firm was accompanied by the following expression of opinion, being similar in terms to many others.

"A practical paper covering the field that THE LOCOMOTIVE ENGINEER proposes to, is certainly needed. We are glad that you make this move, and predict for you great success."

Subscription Price, $1.00 a Year. Single Copies, 10 cents.

SEND FOR SPECIMEN COPY.

PUBLISHED BY AMERICAN MACHINIST PUBLISHING COMPANY,

96 Fulton Street, New York.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. I. NO. II. NEW YORK, FEBRUARY, 1888. $1.00 per Year. or 10c. a copy.

A New Safety Improvement for Automatic Brakes.

The device here illustrated and described is intended as an improvement on the automatic air brake, and has been in use for some time on the extensive system of the Chicago, Milwaukee & St. Paul road.

It is so simple as to hardly need other description than the engravings. Lower cut on page 3 represents it as applied to the trucks of tenders, being practically the same as applied to four-wheeled trucks under all coaches. *G* represents a tumbling shaft running across the truck frame each side of the center piece; to this are fixed the short or trip arms *j*; these arms straddle the posts *E E*, and are tripped by the nuts *b*. The posts, *E E*, go through the lower part of truck frame or guides fastened to it, and are bolted to the buffer *H*. Through the levers *d* and connections a rod is attached to an air valve in the main brake pipe. The upper cut (page 3) shows the attachment as designed for six-wheeled trucks where the wheels *H* take the place of the buffer beam. The cut on first page represents the device as applied to the forward trucks of a locomotive.

The buffer beams *H*, or wheels *H*, are suspended directly over the track and near enough to it to be brought into contact therewith by the breaking of a wheel, journal or axle, or the derailment of a wheel, caused by a broken rail, the spreading of the track, a misplaced switch, or the encountering of any obstruction; and when this occurs, the beam or wheel and their posts are lifted, which action, through their described connections, instantly turns the valve lever of the air-brake pipe, letting out the air, and causing the setting of the brakes through every part of the train.

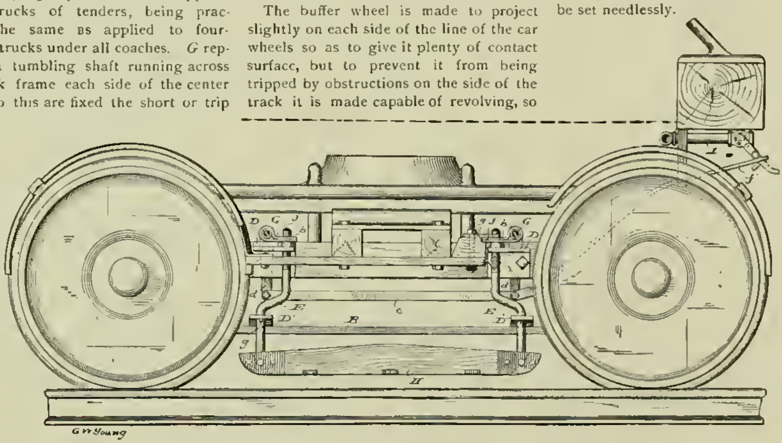
The buffer wheel is made to project slightly on each side of the line of the car wheels so as to give it plenty of contact surface, but to prevent it from being tripped by obstructions on the side of the track it is made capable of revolving, so that when it strikes such an obstruction it will turn, and its arms will wedge the obstruction aside and out of the way.

The valve can be opened only by direct upward pressure on the bottom of the foot or buffer wheel of between six and eight hundred pounds.

The only wear that the apparatus is subject to is that on the bolts which secure the beams *H* to the suspending posts, and these need be changed no oftener than once a year. No other attention is required.

The beams or wheels *H* hang from an inch and three-eighths to an inch and three-quarters above the top of the rails, and therefore a drop of two inches and a half from any of the causes named will apply the brakes before the wheels have time to strike the ground or before a broken axle can do any material damage.

As the beam with its straps across it follows immediately after the tread and flange of the wheel, and does not project beyond on either side, it cannot be struck by any object except one in the line of the track, and as the posts are made to yield to slight obstructions, the brakes cannot be set needlessly.



AUTOMATIC BRAKE ATTACHMENT TO ENGINE TRUCK.

The brake is known as the Wescott, Bristol & Hinsey Automatic Safety Brake, and Mr. J. A. Hinsey, the president, Milwaukee, Wis., will give any other desired information.

The Jack-of-all-Trades.

He used to be the mechanical oracle of every community, great and small. He could patch up a machine that the machinist swore wasn't worth the rivets required in the patch. He could make a condemned boiler carry more steam than ever without a simmer. He could repair a watch, grind skates, put rivets into bladeless knives, make humming tops and botch up good work with a caution. He was attached to the machine shop and roundhouse about the same as a liveried fool was to the court of foolish kings. His work is over and his days numbered. This is not the stone age, or the iron age, or the age of steel, nor yet the age of progress—it is the age of specialties. A few years ago and a printer must be a writer, proof-reader, pressman and compositor, and know all the details of the business from blank paper to gilt-edged book—even to living on store orders. A machinist must be everything, from a watchmaker to a foundryman. A locomotive engineer must know how to build his engine, repair it, clean it, wash boiler, teach firemen, know the rules of the road and laws of the State concerning the same and we had mighty poor engineers until locomotive engine running was recognized as an exclusive mechanical specialty, and men trained for that specialty. A few years ago, if a breakdown occurred in the shop, all hands sat down and waited for the Jack-of all trades to come to the rescue Now they have men specially trained to look out for the breakdowns. At the Providence Locomotive Works they have a man who has charge of the belting, and if a belt needs lacing he does it in his own room—for he keeps a duplicate of every belt in the place in reserve. If the main belt breaks there is not a hundred men idle while half a dozen repair the belt, the "extra" takes its place and the other is repaired and itself goes on relief duty.

The writer was in a railroad repair shop recently when the division superintendent brought in a typewriter to be fixed—said it was out of kilter. The foreman looked at it, struck a key or two, and remarked: "I don't know much about these things." "Why," exclaimed the superintendent, "you have the reputation of being the best mechanic on the road; I thought you were just the man." The foreman turned to the speaker and said: "I am a locomotive repair machinist, and have carefully studied it for fifteen years; if you will bring me any job on a locomotive that I cannot do that any other mechanic can, I will resign; life is too short for a man to spread himself out so thin as to attempt to be familiar with all classes of machinery. There are men who make a specialty of typewriters, as I do of locomotives. They can repair that machine in half the time, for half the money, and twice as well as I can. I would be as foolish to attempt to put new letters on that machine as they would be to put a new tire on a locomotive."

Let every mechanic have a specialty and stick to it.

Improving the Details.

It is remarkable that men who are employed in a thinking business, like running engines, will not think. We do not refer to the work in general, but to the many little details that make up the whole. Men get used to doing things a certain way, and, being satisfied that is about the only way, never think of such a thing as doing it different or better; all men are not this way, but there is a large majority who are. We remember a few years ago there was a road built over a mountain pass; the grade was extra heavy and the speed of trains, of necessity, was very slow. There was a water tank half way up on each side, and the first man up tried to oil the valves there, after shutting off, but the train was standing still before he got half ready. It was tried a few times, and decided that in order to get any oil on valves in that fifteen miles they must have some in the oil pipe to blow down, or else have self feeding cups in chests. The regular mountain engines were soon provided with the latter.

A short time after, a young runner from one of the valley divisions was obliged to go over the mountain to help the regular "climber." Before starting, the old mountain engineer came over and told the valley man that he could not oil valves at the tank stop; it was so steep the train would stop in a couple of car lengths. The young man tried to get oil down at the tank and got it on roof of cab. Then he commenced to think it over. Before starting back on the other side of the mountain, the young man went over to the mountaineer and told him he wanted to run by the tank ten or fifteen cars, and then let the train drop back to tank, holding it with the air brakes. The old 'un wanted to know what for, and was told to "watch me." At the tank they ran by ten or fifteen cars' lengths, shut off, and the train soon stood still; then it started to drift back; the new engineer pulled his reverse lever back, held the train with the air brake, and the fireman oiled the valves. When they stopped the old man came back and said: "That is a pretty smooth trick; wonder I never thought of that, but don't you know us old cusses don't think of new kinks enough; simple—simple as fallin' off a log. My old father used to say: 'Of all fools, darn a foolish fool.' He must have known me pretty well." Simple as this little story may seem, it is an actual fact, and we doubt if there is an engineman in the country who cannot recall a similar incident. But this is not a wonder; it is the way all railroad improvements, great or small, have been discovered and developed.

Better Signals Wanted.

There is a growing demand in the United States for a uniform system in all departments of railroading. The Master Car Builders' efforts to establish a standard car coupler is a move in the right direction and should be followed at once by the adoption of a uniform system of signals; not particularly station, switch and crossing lamps and signals, any more than the signals or signs given by trainmen. There is such a great difference in this respect that a brakesman from one road may get a job on another road and do considerable damage by giving a "sign" to go ahead when he meant to back up. We believe the Association of Train Dispatchers are attempting to have adopted a uniform system of train orders that, if in use, would be of service and an element of safety to the public. If there was a national rule about engine whistles, the public would soon learn what is meant. Now, every road has its own rule, and these are modified to suit the tastes of different engineers—some of whom never whistle and others are all whistle.

The High Water Mark.

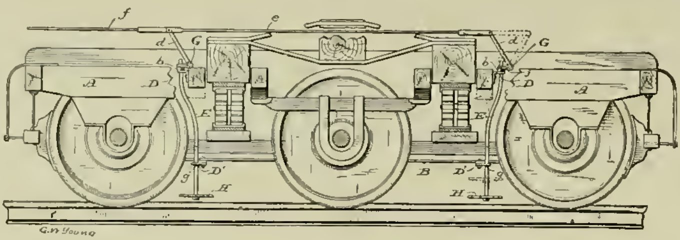
That there are many men who carry water altogether too high for cleanliness, dispatch or safety, all enginemen well know. Often this is because they have been badly scared sometime by some boiler suddenly dropping her water out of sight, and resolved then and there to have enough, anyhow. Others go on the principle that "you can burn 'em, but can't drown 'em," but the great majority of runners seem to think that if there are three gauge cocks they are to keep water in, and they set their pump or injector to "just supply," but there are a hundred things that change the conditions, and, all unknown to the engineer, the boiler gets full. Now why would it not be a good idea to put in one more gauge cock about two inches above the top one, and brand it "steam only." Some will say, "What is the matter with the glass gauge?" Nothing, only that a very small percentage of roads use them, and some master mechanics do not believe in them at all, and hence do not furnish them. We believe the extra gauge cock could be used to great advantage as a safety element.

Relief Valves.

How many men are there now running engines who have not, in their time, blown off a steam chest cover, broken a chest, cylinder head, or broken the bolts in steam pipe joints, or remember some other runner who has? This was generally done by reversing the engine when running at a pretty fair rate of speed; the cylinders becoming air pumps thereby and forcing a pressure into the chests and steam pipes more than their strength would stand. In case of accident, or a desire to avoid it, men will often reverse an engine without opening the cylinder cocks or throttle, the only means of relief. However, there are now many locomotives in service, as well as most of the new ones being built, that have a relief valve, a plain safety valve, placed in the steam chest. This valve is set to carry from ten to twenty pounds more than the boiler pressure, so that a dangerous overpressure cannot be obtained. The device is doubtless a good thing.

Dangerous Train Signals.

We often see outsiders about stations giving signals to trainmen ; and at a wreck each employe of the company has a burning desire to give the engineer signals. The section boss will want you to slack ahead about an inch, and give a signal to go, that, if obeyed, would let you go to the next station. The roadmaster and division superintendent are worse yet. We remember once of being at a wreck where the division superintendent was flying around like a chicken with its head off, and keeping the engine jerking and pulling at derailed cars that could not be put on the track until properly blocked. The engineer was a cool, sensible, experienced man, and he got tired of it, and finally refused to move the engine. The high and lofty official came over to know why his orders were disregarded, and was quietly told that the wreck would have been cleared before had he not arrived on the scene. The engineer calmly said that they had already pulled the trucks out from under a couple of cars and turned one over, by not properly blocking up under them before pulling at them ; said he would take signals from his own train crew only, and Mr. S could do with them as he liked. The youthful official was pretty mad, but he did have sense enough to see that the man was more than half right, and he went down to the depot to get warm. The engineer went back and helped to get the cars yet standing up properly blocked and set, before pulling at them, and on the arrival of the superintendent most of the cars were on the track. There is not only danger to property, but to life and limb by other than train crews giving signals, and all railroad men should discountenance it ; engineers cannot always see who gives the signals from a distance There is more than one brakeman who has lost a few fingers because some boy around the train gave a signal he had no business to. If you have not the right to give signals and see a chance to give one where you think it will help some one out, all we can say is, "Don't."

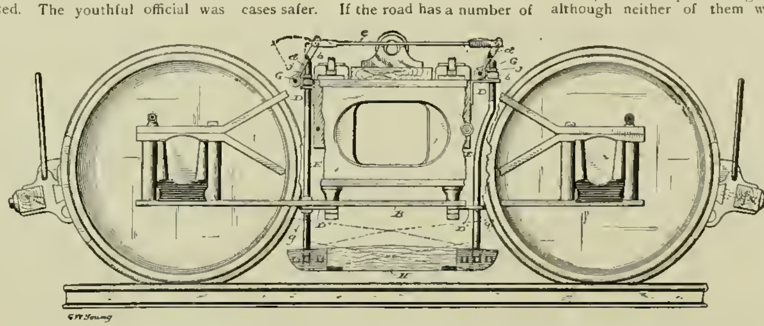


AUTOMATIC BRAKE ATTACHMENT ON SIX-WHEEL TRUCK. SEE PAGE I.

A Point About Automatic Brakes.

Every little while there happens a railroad wreck that could have been avoided if freight trains were provided with automatic brakes, and where the costs of the wreck would go a very long way toward equipping the road with brakes of this description. An affair like the great wreck at Koutz, Ind., last fall, would have been averted had the freight cars been provided with an automatic brake and the passenger train properly flagged. It has been proven that very quick stops can be made with automatic brakes on very long and heavy trains. To hold a train down a heavy mountain grade for many miles, there is no doubt that straight air, or non-automatic, brakes are easier and in many cases safer. If the road has a number of sags or "let ups," so that the auxiliary cylinders can be recharged, the automatic is all right ; but on a grade that to release the brakes for a moment means a runaway, the men are afraid to risk the automatic.

On all ordinary grades, up hill, etc., the automatic is the best ; in case of breaking in two, if the conductor wants to stop for some trouble at the rear of a long train, or any like cause, it is superior to any non-automatic brake, but its great advantage is that it cannot be neglected. In hard times, hose that leaks, pipes that leak, etc., must be kept in repair, or the brakes will set ; to be used at all, to allow the trains to move, the brake must be in repair ; on a non-automatic brake, it can run down until it becomes entirely useless.



AUTOMATIC BRAKE ATTACHMENT ON TANK TRUCK. SEE PAGE I.

The Fool-Killer Wanted.

"An old engineer told me the other day that locomotives were habitual cranks. 'Why,' he said, 'only a year ago two engines came from the same shop, were made from the same castings, were put together by the same workmen, but one of the two engines wouldn't budge an inch faster than fifteen miles an hour, while her companion could easily roll off sixty miles an hour under half the steam it took to send the other engine fifteen miles an hour. We crowded every pound of steam upon the fifteen miler, but no! she wouldn't move an inch faster, although she would draw four more heavily loaded freight cars than the engine that rolled up sixty miles an hour to her credit. Suddenly the fifteen miler came to a dead stop between stations, and there she stuck and couldn't be made to move again. Almost at the same time the sixty miler, on another portion of the road, came to a dead stop also, and she couldn't be made to move. Both engines were drawn back to the shop, were taken apart, examined, put together again, but no! they could not be made to move even under 150 pounds of steam. Stop running they would, and stop running they did, although neither of them were a year old. Finally they were broken up and sold for old junk.'"—*Albany Argus.*

What blatherdash. If any engineer ever told this little lie to the alleged reporter he was engineer on some horse-boat—not a locomotive. That engines have peculiarities no engineman will dispute, but the day of mysteries about machinery is dead and rotten. The management that would sell for old junk $16,000 to $20,000 worth of year-old locomotives because they were "cranky" does not exist up around Albany. If this reporter, or any of his acquaintances, will show us a locomotive that won't go "and can't be made to go," we will eat it, tank and all.

What Is Nerve?

From a railroad standpoint, it is often questioned whether a man has nerve or the lack of it that makes him face any emergency as cool as if he were only sitting down to his dinner.

Is it the absence of nerves or the control of them? We are inclined to think it is the latter. Many a man who has acted the cool hero in a fatal catastrophe has found himself prostrated by nervous exhaustion the next day. This kind of men have the first physical requisite for successful engineers, and to this nervy control of themselves many a train load of passengers owe their lives or limbs.

Not long since a brother engineer pointed out a man on the street, and said: "There is the nerviest man in this State. Why, he could cut your heart out and hold it in his teeth and sew up the hole, if he thought it was best for you or the community, but he would be sick next day. Two years ago he was running the snow-plow engine and struck a lot of ice at a tank siding on the A—— branch, turned over and had a narrow escape. After steam blew off, he found the fireman was under the tank and had his leg badly crushed, and was pinned down by the tank flange. Most men would have been crazy and gone for help; not he. It seems he took in the whole situation at a glance. He crawled under, and found the fireman was stunned by the shock and had a very bad leg. Instead of trying to bring him to to thrash around in his frenzy to get out, he just made sure he was alive and crawled out. Then he made sure nothing could take fire, and then went and threw the switch at each end of the siding, so that no train could run into the wreck. On returning, he built a fire; there was no house for over three miles, and no train due for nearly four hours. Then he went under that tank and got his fireman roused up, and then did something I never would have thought of, and could not have done if I had. He took his knife and stripped the pants off the fireman's crippled leg, took a piece of the bell cord and tied around the limb above the knee and twisted a stick into it. Then he cut off his leg where the tank had it crushed onto the frozen ground. Well, he worked a long time, and finally got him loose, wrapped up the bloody stump in his own shirt and carried him out to the fire. He dare not leave the man, as it was bitter cold, so he made him as comfortable as he could on the cushions and clothes, and built a wind-break around and over him with a lot of new ties and kept the fire up. Never got scared a bit, and even talked that fireman into believing he wasn't so terribly hurt anyhow, and kept his spirits up till a train came. It was my train that got there first, and what did I find? The fireman's arms around Jim's neck, and Jim in a dead faint; yet he was standing by the fire when I struck the lower switch, and he was the sickest man of the two for the next month. Why, he tells me it makes him kind of sick just to see blood. Now that is what I call nerve. Oh, the fireman, he got along all right and is running the stationary over at the shop. And what did the company do for Jim? Oh, handsome, handsome; after puffing the road till spring over Jim's bravery, they allowed him full pay for the time he was off—after a committee of us fellows went to the office the second time and insisted on it.

"Well, stranger, I must get my old girl out, as I leave at .38. Come up to the division to-morrow night and I will introduce you to Jim. Cigar? Well, yes; don't care if I do. Well, be good to yourself," and he was gone. Since then we have become very well acquainted with "Jim," and find him a kind and gentle husband and father, a man who loves his calling and studies it; cool, level-headed, temperate, plain Jim, with a woman's heart and an engineer's nerve. May his sons and his grandsons be like him!

Little Things.

Did you ever think how the world is made up of little things? Did you ever think that the great Polar whales subsist entirely on minute little insects, and wonder how many million a day it took to keep a monster of over a hundred feet in length? The writer has been impressed with the importance of small things by the breakage of some small part of a locomotive, that caused great damage; but the value of little things, when there were lots of them, was forced onto our notice a short time since by seeing a large machine in the shops of the Elevated road, for destroying tickets. An L ticket is a very small affair, but they must be counted and destroyed. When General Foreman Campbell showed us this machine with its hopper and two cylinders of revolving knives, and told us its use, we asked at once why not burn them, and was told that their sale as waste paper amounted to a considerable item. The elevated roads carry half a million people every day, and 500,000 pieces of pasteboard make quite a pile.

Unhandy Tanks.

The common locomotive tender has some very mean and unhandy parts. In the first place, there is a flange all around tank to keep in coal, cinders and water. The water hole is placed on top of a sort of deck, and to fill the tank full of water and not run it over, and do it quickly, is about as easy as to drink out of a glass balanced on top of a lead pencil. The water run over makes mud and dope of coal-dust and cinders, rusts out top of tank, and makes firemen a world of work to keep the back of tender as tidy as most roads expect. A flange around coal pit only, and the coal-pit made larger at top, would be an improvement. Some arrangement should also be made to send the overflow of water to the ground by some other route than the coal pit. In winter, this would be found a big saving in the way engines steam.

Remembering Orders.

The writer was riding on a locomotive some time since when the engineer got an important and complicated order. He read it over a couple of times to himself and said to the fireman: "Don't let me forget my orders." The fireman said nothing, and we steamed out. Ten minutes later the engineer whistled for the next station. "Don't forget those orders," said the fireman. "All right," said the engineer. At the next station this was repeated, and so it was at the third and fourth; at the fifth the engineer showed some signs of annoyance, and finally said: "Got a do-not for the Springs." The Springs was several stations away yet, and the fireman was mute till we got there.

Now how much better it would have been had that engineer have given the fireman the order to read, or read it to him; by so doing he would have made him an interested partner in his own responsibility; he would have acknowledged him as an intelligent workman, as an apprentice; he would have lessened his own danger and had the help of an ever alert lieutenant. Engineers cannot do a better thing than to reform the close-communion train order system. Put up a hook and hang every order on it and tell the fireman to read them as soon after they are received as possible. You will feel better as an engineer, the fireman will be proud of your confidence, the company receive more perfect and intelligent service, and the public more safety, and there will be fewer forgotten orders.

The Oil Box.

One of the first things that strike an English engineer or fireman as odd, on stepping upon an American locomotive, is the oil box, with its six or seven kinds of lubricating juice. There is the bucket of tallow, the five gallon can of black or engine oil, the two-gallon one of sperm, the one-gallon can of headlight, and its half-gallon cousin of signal, and an old beer-bottle of boiled oil to paint the stack, and perhaps, a little can of a secret mixture or "oil cocktail," that this particular engineer believes is good for his wheezy old air pump. In England there are few roads that furnish more than one kind of oil—a clear, amber-colored fluid that is a good lubricator, and burns well in the signal lamps.

Blindfolding Locomotives.

Men who care for good headlights, and have to run on roads where they double head, know how soon the cinders peck up and frost over the glass in headlight of the second engine. On some roads, the boys have the light fastened to bracket board with one central bolt and thumb-screw nut, and, by loosening this they easily turn the whole headlight around and let the cinders peck up the back. Others have a curtain made of oil-cloth and "blindfold the old girl," as they call it. Either scheme saves the glass.

More About the Roundhouse Foreman.

BY JOHN J. BINGLEY.

It is a very important part of a roundhouse foreman's duty to see that his men are supplied with a sufficient quantity of labor-saving tools, and the next important thing is to have a place to keep them when not in use.

The writer at one time, on taking charge of a roundhouse, made out an order for about thirty-five wrenches at one time. I had two boards ten by eight feet put up on the wall, and a sufficient number of pegs and hooks placed in rows on which the wrenches, spanners, chains, jack levers,

Fig. 1

etc., were to hang. A large R. H. was cut with a half round chisel on every piece, and an order was posted above them, stating that any person using these tools and not returning them would be subject to suspension, and any of the wrenches marked R. H. found on any engine would be reported to the M. M.

By this means a good set of tools was secured, and after a week or two the men soon learned to put them in place. They soon learned to call certain wrenches by name, as check wrench, feed pipe wrench, pedestal bolt wrench, injector wrench, etc., so that as soon as they got the order one would say to the other, you bring such and such tools, and profanity and bad tempers soon vanished.

A bar of iron (Fig. 1) 3x½ in the center and tapered at the ends, four feet long, was used to lift off steam chest covers, the oil cup was taken out, and the casing taken off, the nuts taken off, and the cup was put through the hole in this bar and screwed into the steam chest cover, and a man at each end could lift it off very easy and lay it on the floor, and no fingers burnt. A stud puller was often needed; this was a round bar with an eye and set

Fig. 2

screw (Fig. 4) at one end. After they were started with this, a pipe tongs or alligator wrench would take them out.

In putting in springs small jacks, 1½" to 4" high, were very useful to raise the equalizer so as to couple or uncouple the spring hangers. A small hydraulic jack, like Fig. 2, was very useful; it was made of soft steel 2" square; a ⅞" hole was bored in both ends; a nut with a thread in was screwed on one end; in this was a ⅞ fine thread screw with a leather cup on the end; on the other end was a plug fitting the hole, with a leather cup on its inner end; the screw was run back to the outer end, the plug taken out and the jack filled with oil and the plug pressed down; by forcing in the screw the plug was forced up, and did good service in raising equalizers.

Chains with grab hooks made of square iron, and close enough to grab the link on the outside, were often used with a pinch bar to pull down the end of the spring to make the last hanger.

Fig. 3

Flat bars (Fig. 3) 2x1" with ¾ holes drilled at about 1¼ center to center, and a hook bent on each end to hook on the top guide; a pin or bolt put in these holes formed a fulcrum by which the crosshead could be pinched from one end to the other when the packing was to be examined or the brasses filed.

Many were the devices employed to get the piston out of the crossheads; a small screw-jack with spanner nut was used sometimes. Often a drift and a nut or two was put in between the wrist pin and the end of piston, and a sharp blow would start it out. But a better plan was to make a steel drift to go in the crosshead keyhole; it was narrow enough to admit of a half round piece of steel about ⅞ thick, to slip in and bear on the end of piston rod, and two pieces, one above and one below, resting against the crosshead end of the keyhole, and the key drop down between them until tight; then by driving the key the rod was forced out; with this rig it was not necessary to take down main rod.

Blocks to block the crosshead should always be used when the main rods are taken down, if steam is in the boiler; for if the throttle leaks, or some one not knowing the rod is down may try to move the engine, out will go the cylinder head I have seen more than one go out this way.

It is very important that a supply of bolts and nuts of the different sizes be at hand, ready for use, for if they are not prepared beforehand, they can never be found when wanted; wedge-bolts of the different kinds, oil cellar bolts, gum washers for unions or feed pipes, and flat keys, and split cotters. I effected quite an item of saving in flat split keys on one road by a little device like this: in the spare time, when the trains had all gone, I had the men get the old hoop iron 1" wide that came around the bales of waste, and with a pair of bench shears one man would split it in two ½" wide; another man would take these strips, say 24" long, and with a block with two pins, one ½", the other ¼", set close enough together to place the hoop iron between (Fig. 5); the flat

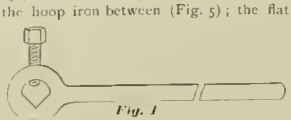


Fig. 4

keys could be made very fast; they would make 300 at a time, and for a long time these were the only keys used, and were as good or better than the commercial ones, as we could make them any width, and did not have to run to the storeroom every time we wanted a few. The short end was put between the pins and bent back slightly, and the long end brought around and given the "set" over the small pin, as in Fig. 6; one was made on each end and then cut off by the shears.

A Proving Test.

A number of tests have lately been made with the tire-heating device that was illustrated in our last issue, that are very flattering both as to the economy and efficiency of the apparatus. At the shops of the Pennsylvania R R. Co. at West Philadelphia several 48" tires were removed in from six to seven minutes, and

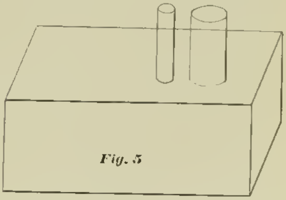


Fig. 5

several new ones of same diameter put on in from twelve to eighteen minutes each. The Lehigh Valley road furnished a hard subject in a pair of 54" tires that they had tried to remove in several ways, without success. The tires were rusted to wheel centers, and both wheels cracked through the hub.

As the tire expanded the cracked center also expanded; this center was cooled with hose, when the tire came off easily; the second, although cracked worse than the first, came off in forty minutes. The tires taken off these broken centers were measured while hot, and again after they were cool the day following. They had expanded a full ¼"; the tire was not round; the largest way was ½" larger than when cold, and the small-

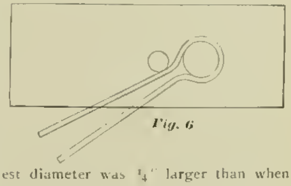


Fig. 6

est diameter was ¼" larger than when cold.

Tests were made in the presence of Master Mechanics Kinsey, Mitchell, Clark, Hofecker and Campbell, of the Lehigh Valley R. R. Co., and Mr. Garrett, Master Mechanic of the Pennsylvania R. R. Co. The quantity of oil used averaged from half a gallon to three-quarters to a tire, a gallon of oil being used up in about thirteen minutes.

H. K. Porter & Co., Pittsburgh, Pa., built 104 locomotives during 1887. They make a specialty of light locomotives for all purposes.

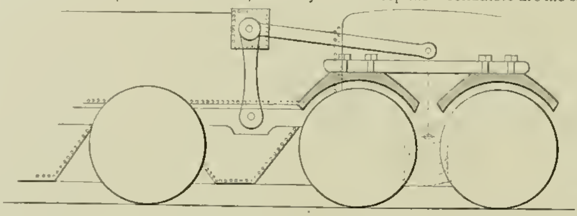
The P. & Ft. W. Road built 35 new engines at the Ft. Wayne shops last year.

About Driving Brakes.

Driver brakes are now being applied to a great many locomotives, and a few minutes' study of them presents several thoughts. In the first place, it depends a great deal on the make and kind of locomotives they are to be applied to, and the country and climate in which they are to run. Every engineer will look at the different kinds and different ways of applying them and then judge of their merits or demerits from his own footboard and his own country.

The first and general mode of application was to place both shoes between the drivers and force them apart by a toggle joint movement. This is hard on the machinery as well as the brake; the drivers are forced apart, and all the strain brought to bear on the driving boxes; it affects the side rods, and one wheel is trying to tear the shoe up and off, and the other driver is trying to shove its shoe down under its tread, where it seems to think it belongs.

The later style of placing the shoes on each side of the drivers, and bringing them together, takes a great strain off the boxes and is much better, but has a disadvantage in that it multiplies parts, and, on consolidation engines with small wheels, it is in the way, and especially so in a country where there is much snow. The writer was employed for some years on a mountain road in the far West using heavy consolidation engines with but 36 inch driving wheels. The grades being 217 feet per mile, it was necessary that engines should be well provided with means of controlling themselves light. As one would take as many cars down a mountain as several could get up, a large per cent. of the mileage was made by lone engines. The entire equipment was provided with the straight air brakes, and the engines had tender brakes, water brakes and most of them had driving brakes. Owing to the crowded condition of the heavy machinery, these driver brakes were obliged to be placed between the forward and main driver, and the air cylinder was in front of link, making it hard to oil these parts. From the size of wheel, the brake shoes had to hang very low. These brakes were only to use in an emergency, and a great nuisance they were. If you ran through snow, and that was more than half the time, they were a solid mass of ice, and carried it up and over the working parts of the engine. If you used sand, they carefully sifted it over the links, eccentrics and driving boxes. If you got off the track, they would break the casting or catch on the rail and shove up. If they broke off, you were glad of it, if they did not, you had to disconnect and take them off before you could get a frog under the wheels or block up to get them over the rail. If you used them while running, two to one they would tear off and put your mill on the ground, and, taken altogether, they were an element of safety and danger that a man had been learned to think well of, but which his experience said was a first-class nuisance. A few cases where, at the dread hour of midnight, the writer was obliged to take off an icy driving brake from each side of his pet, while the fireman was half a mile down the track flagging the express, that was stuck fast four miles away, and the mercury capering around the bulb of the thermometer, rather got us down on this class of driver brakes; but, like a boy who has no faith in his father's religion, we disliked to say much about it, but kept up a lively thinking; the driving brakes were there before we were and were our superior by right of seniority. A man cannot think of anything very long or very carefully without thinking out something new, good or bad, and finally we had in our note book a sketch something like the one below, and we reasoned thus: Now, if we could put those shoes on top of the wheels, they would never get in the way. If they were on the two center pairs of drivers they could have shoes the full width, as these drivers have no flange; the braking force would wear on a part of the tire now only used to turn off, and they would keep the



grease off the face of wheel. By being on top they will catch no sand or snow, won't have to come off to get engine on track or won't break off when she strikes the ties. By placing the cylinder in the center of frame and in front of fire box and connecting to a cross-beam, the strain will be equal on all the shoes and do away with one cylinder and four toggles. The breaking force will simply be a matter of lifting the weight of engine from the journals to the periphery of wheel—the true principle. By stiffly bracing the connecting bar to the expansion brace lug on fire box, we prevent the shoes from being forced ahead or back. It can't stick. It is cheaper than those in use. It is not in the way when oiling. It can be repaired without getting under the engine. All of this and a few similar points we learned by heart, and finally decided to go three hundred miles to headquarters, show our great invention (?) to the kindly superintendent of machinery, get it adopted and take our place among the inventors of America and benefactors of civilization. We recall how grand we felt; like the first spasm of true love, it was too pure to talk about. We took the night express and struck the big shops about 7 A. M., got an excuse for breakfast and went over to the roundhouse to await the arrival of the highest official. The first engineer that came in was an old passenger runner who had a new engine. He was twenty minutes late. "Well, can't you make it?" tartly asked the foreman. "No," said the runner, "nor anyone else with that engine till she is fixed; she is logy, slow and won't start to move for a minute after you open the throttle, and don't swing 'em when she does go. You have got to put some life in her—give her more lead." "More lead!" echoed the foreman; "now let me give you a little advice—don't you say 'more lead' to the old man; he will tell you mighty quick that if that engine needed more lead she would have got it in the shop where she was built; they know what they are doing." "I will trade back for the old engine and give boot; she is little, but she can make that time better than the big one, till she is doctored," remarked the engineer, as he went home disgusted. The next man came in with coal-dust and a tired look about his eyes, sat down his lunch pail, threw his coat on it and pulled the register towards him with a look as if he would have liked to own a rubber stamp to save the exertion of writing his name. "Say," to the foreman, "you will have to fix that seat. All these new consolidators are the same; you can't sit on it and look out of the window; it is too low and too far back; can't reach the throttle either, and it is so narrow that a man can't half sit on it—wish you would change it." The foreman looked at him in a lofty manner and said: "Young man, if you want to take the responsibility of boring them new cabs full of holes, all right, I won't. I ain't going to have the old man jumping onto me. He was East when them engines was built, and that seat is there for some use, or they wouldn't put it there. I know what I am doing; just go and strike the old man and see how soon he'll tell you what is what." The engineer swore he was not fit to go out the next trip, laid off and went home. We commenced to think of the changes we were about to propose, and forgot half our piece. The foreman talked on, half to himself and half to three or four of us who stood around. "Nothing makes the old man as mad as some of these engineers coming around and wanting to change something; nothing is good enough for them. How are we going to ever get the engines down to standard, I'd like to know?" We went over and waited for the terrible "old man." We had never spoken a dozen words to him in our life, and the longer we waited the less we felt like opening our heart to him. About 9 A. M. he came, recognized us, asked how the snow plow was, and what we were doing there, and what he could do for us, and led us into his office. After two or three gasps we managed to tell him we had a little business there, and if he would give us a pass home, we would go up on the noon train. And thus was lost one of the great inventions of the day, and this is the first time it has ever seen daylight since. We believe it would be the best thing yet in the place it was intended for, and we also believe that foreman was a lazy liar, and we were foolish to pay any attention to him, and that the superintendent of machinery would have tried the scheme if we had showed it to him.

How a Superintendent Flagged.

Some years ago, not very many, however, there happened on one of our Western roads one of those little incidents that are interesting, amusing and instructive, but where the laughable part is not really enjoyed until some time after, things being serious just at the time.

The reason that we don't say just when and where this all happened is because the engineer is alive and well yet, and the superintendent is now vice-president and general manager of a great system, and will appreciate this joke on himself all the better for not being given entirely away; but for the tale:

It was snowing everywhere from the Mississippi to the Rocky Mountains, and what trains were not stalled in drifts stack high, or abandoned to avoid stalling, were not on time by many hours. The mails must be kept moving, however, and the mail car and one coach were about the size of most trains, and passengers hardy enough to venture were few.

One old engineer succeeded in getting over his division nearly on time, and found at the end of the run that there was not another engine to go over the next division as "pilot engine," to run ahead of the train to clear the track of snow, cattle and other obstructions, and he was asked o go by the superintendent himself. The old man shook his head, remarked that it was "pretty rocky," but finally said he would go if they would wait till he got ready. As there was nothing else to do, they waited.

Our hero was cool, he looked out over the prairies into the storm, and told the hostler to take the engine to the house, have the ice knocked off the running gear, a full tank of coal and water put on, and the oil cans all refilled and fire cleaned, while he and the fireman got outside of a hot supper and had their lunch pails filled for a siege. In half an hour all was ready, the light engine stood in front of the train, and both in front of the office. The superintendent was nervous and concluded to go himself on the light engine, so that there might be no mistake. After oiling around carefully, looking to the headlight and pounding the sand pipes open, our engineer got up on the engine. The fireman had the pointer at 140, and all in readiness for a hard run. The superintendent was perched up on the fireman's seat, hid in an ulster and a pair of No. 13 overshoes, and inwardly chafing because the engineer was so slow As the old man wiped off the oil can, he said to the fireman: "Light me a lantern and put a couple of torpedoes on the guards." The official had to get up for Mike to find the booms in his seat-box, and asked the engineer: "What in thunder he wanted another lamp for, the fireman had one lit." But the old man put the light in front of his box, got his legs in front of the reverse lever, and remarked as he pulled out: "That is for me." The storm was raging in all its fury, and at every cut or bank the engine dove out of sight for a moment, and then emerged covered with a shroud of purity. Through every crack and opening in the cab there was a thin knife of sharp wind and snow pointed at the three men, who were straining every nerve to see before them; when out onto a high fill this was possible, but any other time it was not. Half a mile back they could catch occasional glimpses of the headlight of the oncoming train.

After passing a certain bridge, the engineer turned to the fireman and said. "Mike, fill her up to the crown sheet." The fireman obeyed, but wondered what had struck "the old man." When Mike had a couple of tons of coal in the firebox, he dropped the curtain and the old man said: "Now, don't pay any more attention to the fire, but look out for stock; these cuts will be full—half snow, half bulls." "Got one here," said the fireman, as they emerged from a cut. "Look out, now," said the engineer, but they made a mile or two at a good speed without seeing any stock; but the old man kept up his lookout and cautions. The next deep cut had a herd of stock in it, huddled up to keep out of the fierce wind; into this cut the old Roger plunged, covered herself with snow—and cows—reeled a little, and stopped.

Experience had taught the fireman that that reeling meant off the track, and he had lit head first in a snow drift at the first lurch. The engineer coolly threw the reverse lever ahead again, and said, "Mike, flag the train." But Mike was gone. "I'll flag," said the half-frozen official, as he got the fireman's lantern; "but why don't you go? you're out of the cut, and they may run into you" "The trucks are on the ground; you fly!" was the command; he did fly.

Our superintendent was one of those men who can get a poor engineer or conductor up into his office and scare him into the blind staggers by deep questions on operating railways, but when he came to the trials of the operation he was as bad as a green boy off a farm. He had the lantern and he was off the engine in a minute, around the tank in another, and before the third minute was up he stumbled over a dead steer rolling down the bank, and his lantern went out at the first stumble.

Our engineer quietly, but quickly, turned up "his" lamp, and started to go back himself, but met the bold Mike at the gangway, and that hearty seized the signal lamp and went back on a double quick. In a few minutes the express stopped a few feet behind the disabled engine. The hatless, snow-packed officer now showed up, and never ventured a remark while the train men coupled the second engine into the first and pulled her onto the track, gave her a shove through the next snow cut, and came back for the train. He took a seat by a red hot stove and tried to dry out.

A few days later he met the engineer and said: "I learned a little real, live railroading the other night. If you were as green at it as I am there would have been blood spilled over there." "And," said the engineer, "if all the engineers in the country were as poor practical railroad men as yourself, what then?" The young but honest official shoved his hands deep into his trousers pockets while he hunted his brain garret over for a fit comparison, and finally remarked: "We'd better have the cholera." "Remember one thing, old man," said the knight of the throttle, "and that is to always protect yourself, running or standing still; look out that you keep out of the other fellows and keep the other fellows out of you. I am going out with a very leaky old scrap heap to-night, come along, and I will give you a practical answer to your oft-wired question, 'What is the cause of this delay?'"

A Chance for a Novelty.

There is a good investment, on a small scale, for some builder of novelties to put on the market a cheap but fairly accurate model of a locomotive valve motion. It need not be all made of metal, but the larger parts can be made of wood; it is not necessary that any of it should be polished, but all measurements should be correct. It should be adjustable to different strokes of piston and different travel of valve; the eccentrics should be arranged on shaft so that they could be set at any point and slotted to change the throw; it is not necessary, for the purpose proposed, that different radius of link should be used Ordinarily strong and simple, all parts named and sizes given. A device of this kind may be sold in large numbers if it is not too expensive. If it costs $25, a good many lodges of engineers and firemen would buy them, but if the expense could be brought down to, say $10 or $15, not only most of the lodges, but hundreds of individuals would gladly buy one for their own instruction and reference. No invention is necessary; drawings of good valve gear models are to be had in many places, notably at locomotive works.

Who will supply the want?

John J. Bingley and H. R. Jones, contributors to No. 1, come out again with instructive letters in this issue.

J. E. Phelan gives enginemen some sensible advice that will be read by all in the motive power departments from heads down, the more so as Mr. Phelan is well known as having charge of more than 3,000 miles of road, as general road foreman of engines under the general master mechanic of the Northern Pacific.

James Heron writes from the shop, and his showing up of some of the practices in boiler shops cannot fail to attract wide attention.

Correspondence

Criminal Boiler Work.

I received a copy of your paper and was much pleased with it; it has occupied a field much in need of such a monitor, and I am sure you will do good. When I was a young man reliable mechanical papers were not to be had, and a mechanic could not learn different systems of doing work, and keep track of the improvements in new machinery in his special line without working in many different shops. I traveled a good deal in my time, but if I was to learn boiler-making over again I should not weigh anchor so often, as a man can see cuts and read well-written descriptions of all new machines and get hold of all new kinks in a paper like yours, and at his own fireside. I have worked in the boiler department of many shops, and have always found that in shops where there was system, good management and intelligent work, you would find reading mechanics, and in rule-of-thumb, strong-and-ignorant shops, men who do not read. I recently resigned my position of foreman boiler maker in a large shop, to work as a journeyman in another shop, a railway repair shop, for a short time, to get the run of the shop and the men before taking hold as foreman. I found that of over forty men in the boiler department, not one took a mechanical paper, and the machine shop was no better. These men had been employed in this shop from ten to twenty-five years, and all they knew was learned there. They were behind a Chinese wall of ignorance of good boiler practice and did not know how to get out, and did not want to get out. Foreman or men were never allowed a day to visit other shops. Their system was the cut-and-try kind, and their work crude as the boiler work of 25 or 30 years ago. These men had lived for a decade amidst the greatest improvements in steam boilers and knew nothing of them. Right in the same neighborhood another road does the best of work; the shop is run on a system, the apprentices are obliged to attend drawing-school, mechanical papers are furnished and read, and improved machinery or tools discussed and studied, and graduates from this shop find positions of responsibility and trust open to them from far and near.

While I was at the old-time shop, there was an engine brought in for general repairs and the boiler sent to our shop for a new fire box. Here the flange turner is also the fitter up. He goes to the saw mill and gets six pieces of pine about an inch square and six feet long; he uses these to get dimensions Out comes his knife, and a nick or notch is cut for a size where his thumb comes. When he gets the sticks cut up enough off he goes, and comes to a halt about ten yards away and comes back—he has forgot what the top stick in his left hand stands for—and he repeats, sometimes more than once. He got out in this case a fire box that would fit almost any boiler better than the one it was made for. He used the old crown sheet and brought it up level, and made space over fire door 2½ inches instead of 4 inches as before; this brought the crown sheet back 1½ inches, and, as the crown bar rivet holes in crown sheet were there and the crow-feet on shell of boiler riveted fast, with the new order of

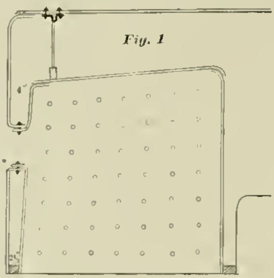


Fig. 1

things, "nothing fit anything else." In Fig. 1 you see fire box as it came to shop. Note sloping crown sheet, the space over door, and stay to shell. In Fig. 2 you see the new fire box, closing space over door and throwing stay out of plumb; see position of holes for stay bolts in shell and large space left near back end not stayed; also note that the flue sheet is not square with flues, being 1½ inches out of plumb. I pointed out to him his mistake and was told that he had put up more fire boxes than I ever saw, and that he had worked there for twenty five years. When I called his attention to the matter, he had not drilled holes in side sheet of fire box, and by loosening up a few clamps he could have placed the box in proper position, but he had an idea and hung to it. I thought that as the M. M. had asked me to take charge in a short time I would go to him, as I considered the job a dangerous one. At noon I made a sketch of parts as here shown, and took it to him.

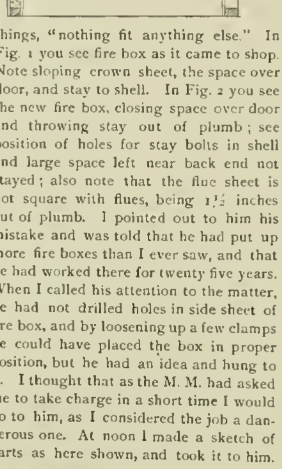
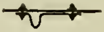


Fig. 2

He did not show up in boiler shop, and the job went on. They had to cut away most of the flange of fire door to get box in shape, and the rivet holes came close to edge and in the flange. They wanted me to finish it, but I refused, showed foreman how stay bolts came opposite rivets, etc., and he finally let another man finish the work, asking me to rivet and calk. When the box was in shell and ready, the crown bar stays were all out of shape; No. 1 brace came nearer fitting No. 2 bar than its own; they were going to bend the jaws of the braces, but finally decided to change the crow-feet on shell; these they took off, and instead of making new ones, plugged holes and welded on a piece, setting the lug to one side, thus:



Now what will a thing like that hold? All the strain comes on the short side, the long one will stretch; and think of a weld in old iron through a plugged hole. After the new crow-feet were in we had to bend the lug to one side to get jaw of stay on. In some places we put in 1½ inch stays where the original size was ⅞. They did not put the expansion plates back inside of shell; the M. M. said they were a humbug. Think of this kind of work in a locomotive boiler carrying 140 pounds of steam. This kind of work is little short of manslaughter, and might furnish the clue to some of those mysterious (?) boiler explosions. I now called on the M. M. and resigned, and told him if I took charge of his shop I must make some changes in the method of doing work. He said that to make any change would lose some of his oldest hands, and he did not like that. Finally I asked him how he would like it if I would guarantee to put in a fire box in three days where it now took seven, and he said he would have nothing of the kind: he now understood his methods and his men, and wanted nothing new, good or bad. I am still alive and foreman of a first-class boiler shop where they don't do patchwork on the rule-of-thumb.

JAMES HERON.

Facts and Fixtures About Locomotives.

THE LOCOMOTIVE ENGINEER enters a field for usefulness bounded only by the desire of enginemen for information concerning their calling and the vast territory through which the ramifications of railroad lines run; and will stand out as an Engineman's Bureau, singly and singularly independent and unique in its character for missionary work among the votaries of locomotive machinery.

We want it to condense the mass of phrases and technical points of mechanical learning and feed to this busy world of employes in small doses with plain directions.

All enginemen who are given to reading will profit by its instruction. All enginemen who do not form habits for reading and study may be reached by the force of example and average conduct and performance of those who do.

Education being the steam generating power and valve motion of good government, so must it be the fundamental principle on which must rest the future weal or woe of efficient and economical service for railroads. Where this education commences and where it will end only thoughtful minds can imagine.

The prime object of a railroad is to satisfy the demands of commerce and give a profitable return on original investments. The prime object in the necessity for locomotives and enginemen is the transportation of commerce over railroads and for earning and increasing the proportion of capital invested. If no necessity for profit existed there would be no object in improvement; no object in having skillful engineers and firemen to manage locomotives. Hence, it is as plain as a fire-box door that if the profitable management of a railroad requires skillful enginemen, it is to their profit and advancement for enginemen to become skillful.

For economical work firemen must commence with the management of the scoop-shovel and dampers, and the control of their fire and steam pressure. One of the living wants of the present time is for some one to write a book that may gradually allow the fact to dawn on the minds of many firemen, that all engines have dampers, and that they were originally intended for use. In conjunction with this is a profitable field for some patent-crank who will fix up an automatic arrangement with a "stuffed club" to stand over the "seven-up" firemen to remind them of this and other facts. The automatic arrangement should also take in the right hand side, for "seven-up" firemen usually have the same kind of engineers.

If a fireman cannot count on what a given quantity of coal put into a fire-box at a certain time or under certain conditions is going to accomplish, he don't properly understand the principle of his business, or else there is something dead wrong with the engine or the engineer, or both. An ordinary scoop of coal will average about twenty pounds, and it don't take long to scoop into consumption a ton of this product.

A fireman who will use coal or other fuel only to generate steam that must pass through the cylinders, and hence go into profit of conducting transportation, is the coming man. The engineer who keeps his engine in good repair, free from wasteful blow or demoralizing pound; who uses an injector to supply only sufficient water to make steam demanded for work in sight; who uses steam only in sufficient quantity to supply the actual demands of speed and force required to propel the train under required conditions, while paying proper attention to train orders, signals, and the numerous other duties required, is the first class engineer, and it don't want to be imagined for a moment that such an article can be made out of bass-wood.

To have such enginemen on engines intelligently designed, free from lost motion, pound or blow, is the proper condition of locomotive equipment desired. On the other hand, there is much to be remedied, and we can but hint here at one or two shining marks for the reformer's aim. Who can blame a fireman for developing into an indifferent engineer, when he has never fired an engine known or suspected of being in good condition in any respect; or who has never received intelligent instruction concerning his business from any source? When one finds an engineer possessing a disposition to learn and improve by example or instruction, future skill is assured by a little perseverance. In this busy age we can learn a little every day, but we occasionally stumble over an individual whose head is swelled, and in his own mind has emptied the store room of knowledge, locked it up, and thrown away the key. The sooner such a fellow gets a tie-pass out of the country, the better for all concerned. In his travels he may find some one knowing less than himself and take a pointer.

On many roads we find engines designed with gun barrels for boilers and with cylinders equal in diameter to shell of boiler. Every revolution of the drivers empties a whole boiler of steam into the cylinders. The fireman sweats and cusses or despairs in trying to keep up steam; the mechanical journal comes along with long discussions on the best mode of draft appliances for free steaming, but concerning these engines the natural born fact remains that the only way to keep steam pressure is to choke up the exhaust nozzle, not only to sharpen the draft and add to the vicious consumption of fuel, but also to keep steam from escaping from the cylinders rapidly enough to empty the boiler. Hence, the nozzles become speed regulators and train tonnage regulators also, and the retarded motion of the engine comes down to a bed-rock basis of supply and demand, where the supply regulates the demand. For such boilers dynamite would be a good fuel, but prudence demands that they pass out of existence in the usual way. The class of engineers who take matters easy, and, understanding the expansive principle of steam, diligently apply it, are very valuable employes for such machinery. The principle should exist among enginemen, of making the best possible use of engines and material at hand for doing work. Where such a spirit exists everything runs smoothly.

It is to be hoped that men who have designed such engines may die off in time, if they are not dead now or have not learned better methods.

The discussions of mechanics' conventions and the various railway clubs picture the dawn of a better day. The progress of master mechanics is self-evident. Finely proportioned engines appear as a result, with boilers fully adequate to size of cylinders and diameter of wheels. If the locomotive engineers and firemen will only keep pace with the master mechanics, the successful and economical management of engines for the future is assured.

Enginemen should work and study for the purpose of knowing and doing right. Such virtue is its own reward; but those who think correct methods are not known and appreciated by superiors, don't size it up right.

In any event, patience will be rewarded, for the most patient and persevering men usually die when their time comes.

J. E. PHELAN.

The Man Who Does Not Read.

He is very likely to be a little conceited and think that he knows just how to do things without help from any outside source.

He is inclined to think disparagingly of a "book" engineer or machinist, as he sees fit to call the man who reads and tries to keep posted and up with the times.

He is generally the first to condemn any new appliance that comes out. When the air-brake was first introduced, I heard such an engineer denounce it as a "nuisance, and too much trouble; the engineer had enough to see to, without being brakeman."

Not long since, one of our Western roads applied a few sight-feed lubricators to some of their locomotives. The man whose duty it was to explain to the engineers how to operate them had not carefully read the directions sent with the cups, and so was totally ignorant of one very important valve, the intelligent use of which was essential to the successful working of the lubricator. The manufacturer had to send out an expert to save the reputation of one of the best appliances ever added to a locomotive.

A man who reads was placed in charge of one of our modern automatic stationary engines. The valve, and what was inside of the steam chest and cylinder, he had never seen, and of course knew nothing of its construction. He sent to the builder and procured a "descriptive catalogue," and in one evening, by its perusal, he had a good idea of what was going on inside of that engine.

The man who does not read wonders what is inside, but does not find out until it is torn apart, and even then he does not get the builder's idea, and know why it is so made. It takes him weeks, months, or years to find out what a few hours of study would enable him to ascertain.

How many inventors spend long sleepless nights in "getting up" something, and then find out that the thing won't work, because it is not constructed in accordance with the laws of mechanics.

I know a man holding a high official position on one of the largest railroads of the West, who built, at a great expense to the company, a hydraulic pile-driver, which, with two men, was to do the work of a ten horse-power engine. He had seen the tremendous force exerted by a a hydrostatic wheel press, and concluded that this was just the power to lift a pile-driver ram, and as the pump was so small, two men could easily work it. It is needless to add that the result was failure, and an addition to the scrap heap.

This is a fast age, and the man who expects to keep pace with the times must not expect to find out everything by the slow coach of experience, but take advantage of the delving of others, as it may be condensed in their writings. It saves time, hard work, and many mistakes.

H. R. JONES.

The new engines of the Boston & Albany carry 175 pounds of steam.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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The Seed of Accidents.

The last year has been a very busy one for railroads, and also for the coroner. It is always so. That there should be more accidents where there are more trains is perfectly natural. But the increased number of trains is not the greatest cause of accidents. When business crowds the roads all the motive power available is kept in motion, and the increased traffic makes the officials more than ever careful how they send out new engineers. They urge the engineers to make extra trips and thus make a little extra money during the "rush." In most cases this is blood-money. Blood-money for the already over-worked engineer, and blood-money for the public. In the United States during 1887 there were, not many, but many thousand of trips run by engineers who had been on duty from eighteen to forty-eight hours, and many cases of even more.

It is a rule on some roads to require the men to "double the division." This may be 100 or 150 miles; a freight train gets over it in from 10 to 14 hours, and the engine crew doubles back; before reaching the terminus the engineer has been on duty more than 24 hours, and that they endure it and keep awake and attentive to duty is one of the wonders of the day.

The trouble is a serious one; no man will dispute that a locomotive engineer on duty has responsibilities as grave and great as any other human being—more lives depending on the proper exercise of his good judgment and his nerve, the matter of property in his hands we leave out of the question—no human being will dispute that passenger engineers have grave responsibilities; no human being who has ever thought the matter over seriously for five minutes will dispute that freight engineers, especially on single track roads, have many times the responsibilities of the passenger engineer.

Let the engineer of the passenger train be ever so good, always alert and watchful, always in full control of every nerve, and pull his train along at lightning pace, knowing that he is on time, and has the full right of way, does not make the butchery any the less if some over-worked, careless or incompetent freight man meets him between stations. The freight runner must know his own rights and the rights of all other trains on the road and clear the time of all superior class trains.

Few passengers think, as they pass train after train, safely out of their way in a side track, of the care and worry and work for brain and nerve it took from those dirty-faced freight engineers in their blue over-clothes, to thus protect themselves and the public.

Locomotive engine running must be recognized as skilled labor, treated as such and paid as such.

Skill is paid for its quality—labor for its quantity.

Paying engineers by the hour or mile at pay little above that of laborers is requiring quantity regardless of quality. The quality is good and efficient when not over-taxed, and is worthy of pay in proportion.

No first-class concern tries to work its draftsmen over six hours; knowing that longer hours mean less accurate and less reliable work. An over-taxed draftsman may spoil a machine that can be replaced; an over-taxed engineer may cause great loss of life that cannot be replaced.

Eight hours per day is long enough for any man to run any locomotive in any service, and if the greedy companies will not throw this safeguard around their patrons the general government should throw it around the public.

Instead of making laws to license engineers, would it not be better to make a law preventing companies from using half-dead men to run their engines?

Locomotive Enginemen and Railway Purchasing Agents.

A mistaken impression exists in some quarters regarding the relations which should exist between these two classes of railway employes. No doubt there are cases from which one might conclude that the average purchasing agent considers the views and experience of enginemen as unworthy of notice. But we believe these cases are only the exceptions that prove the rule.

The official who does the buying for a railroad, whether president or purchasing agent, if he has the true interests of his road at heart, knows that the practical men employed in the various branches of locomotive service, from the very nature of their duties, gain information regarding the working and wearing qualities of locomotives, their auxiliary appliances and materials, which is of value to him in determining what to buy and what to pay for it. In the very nature of things, no buyer can sit at a desk year in and year out, and, by any kind of instinct or business shrewdness, act intelligently and wisely on everything coming before him, without "expert evidence" derived from locomotive service men, using those words in their broadest sense, and including all positions, from superintendent of motive power down.

No such official can afford to close up the avenues of information on which, in a great degree, his highest usefulness depends. Least of all can he afford to do so with a view to being "independent," as that word is sometimes used. The true way to be independent is to be at all times well-informed.

It may be thought, with respect to appliances and materials that have been long in use, the buyer needs no further information. But what he knows of their quality is only knowledge gained as to the results given by them in actual service. Qualities often deteriorate, while new things come up from time to time, in competition, concerning which special comparisons and experience may be of the greatest value.

Even in the case of the master mechanic, whose duties bring him into near contact with the practical work of locomotive and car service, the eyes with which he can see quickest and surest are usually the eyes of the working enginemen on the road and in the shops, who are under his orders. If this be true with him, how much more true it is with those officials whose daily duties do not bring them into this kind of contact.

If one make of signal lamps, for instance, is less effective in actual service than another, the difference being any night liable to be emphasized by accident, danger and loss, why should a slight difference in price insure their extended use, when the truth can be readily ascertained? If a certain kind of copper is wanted in the shops, for a special use requiring copper of that particular quality, where is the economy in sending an inferior kind for that purpose, even at a little less cost per pound? Isn't it better economy to use the kind that is adapted to the work? Illustrations equally pertinent could be multiplied, running through the whole range of locomotive service.

It can be safely set down as a fact, that the railroad company whose officials put themselves out of relation with the men who are in position to tell them the frozen truth in practical matters, squanders a good deal of money in the course of the year.

Accidents on the Elevated.

Accidents on the elevated roads are getting rather too numerous for the peace of mind of many people who ride on them, and also many others who are obliged to travel beneath them. The engineers on the elevated roads should not be allowed to work over eight hours nor go on duty unless they had just had at least six hours of rest. The impression has gone out in the country that because these roads run so many trains a day a man has to be a pretty fine engineer to make a success on the aerial line. Such is not the case; an engineer who has never run an engine except on these roads, could not run on any single track surface road in the country with a single degree of safety to himself or anybody else. All the lines of the elevated are double-tracked ones—except, perhaps, a few little connecting branches of a few blocks in length—and one train follows another; none meet, all in plain sight of one another except at a few curves, and these are all guarded by distance signals and watchmen. The engineer of the L needs to be sober, cool, attentive to duty and exercise good judgment about handling his brakes. He has no "flyers" to let by, and no superior class trains to meet.

As usual, the most of the late accidents have been attributed to the engineer. Would it not be a good idea to find out how long these men work per day and how much rest they get? As good wages means good men, find out what wages are paid. Half a million people are carried by these roads every day, and as many more risk their necks by doing business under them. The engineers in this service should be noted for sobriety, good judgment, good pay and short hours.

Sand or Water?

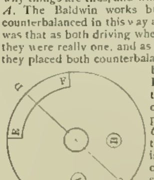
They have re-invented the water jet in England to take the place of sand on rails. This has been used about coal mines in this country for many years, and is in many cases better than sand; it does not make the train pull harder, as sand does. There is another invention which injects small quantities of sand, by steam, directly under the driving wheels. All of these are good in their way, but we believe the sand the best yet. In case of impending accident, sand under the train is very much to be desired, and in some kinds of weather is almost a necessity to even a fair stop. If all road locomotives were provided with good wire brushes behind the drivers, that could be raised and lowered from the cab, the engineer could wipe up sand used for traction and send back that needed for stops at will. The following item taken from the claims of the inventor of the jet system, and published in *Invention*, an English mechanical paper, shows some little difference between the practice of "sanding" in England and in Yankeedom: "It has been customary to drop sand upon the rails in front of the driving wheels, and numerous valuable lives have been lost from men falling off while sitting in an exposed and unprotected position upon the front part of the engine to sand the rails."

Headlight manufacturers for the past two years have been indulging in a general skirmish in the way of cutting prices. And, of course, railroad buyers take advantage of this state of things. As a rule, there are two sides to the profit and loss account in such fights. Quality is apt to become a secondary matter where the chief competition centers in the slashing of prices. By and by some manufacturer will take steps to get the verdict of practical enginemen on his wares, and then the fight may turn upon quality, not price. Quality in a case of this kind means safety or danger; and competition, where price is the pivot, is always on the side of danger

ASKED & ANSWERED.

(1) Northwestern, Chicago, writes:

I am firing a Baldwin locomotive that has a heavy counterbalance in each wheel, but it is not opposite the crank pin; now I have always thought this weight was to balance the weight of pin-boss, pin and connection rod, but my engineer says it is to lift the rod and pin up and past the center, and it is placed there so as to be ahead of the weight it lifts, and thus have more purchase. I think he don't know much more than I do; the roundhouse foreman can't explain it; and when I saw your paper I made up my mind to ask you why things are thus, and what advantage it has, if any? *A*. The Baldwin works built a lot of locomotives counterbalanced in this way a few years ago. The idea was that as both driving wheels were fast on one shaft they were really one, and as the pins are "quartered" they placed both counterbalances on a symmetrical line



between the two pins. Look at the sketch, *A* is the crank pin on one side of the engine and *B* the pin on the opposite side. *C D* is a center line between the two pins. *E F* is the counterbalance placed opposite the two pins, the same on both sides. We believe the idea had more disadvantages than advantages, as the works abandoned them. No doubt a pair of wheels so counterbalanced would be in perfect balance on a knife edge or a still balance, but in rapid motion would cause the engines to ride very hard, and axle boxes to heat. Take, for instance, a very wide pulley and have a weight at one edge; if you put a counterbalance opposite, but on the other side of the pulley, the pulley will be in perfect still balance; but put it in rapid motion and it will give a jerking and twisting motion to the shaft, one weight pulling one way, while the other is pulling in the opposite direction and heating the boxes; change the weight to a point exactly opposite and one balances the other in its path, producing no effect on the shaft.

(2.) Fireman, Tyler, Texas, writes:

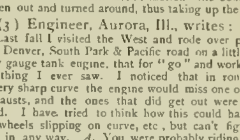
My engineer has been at the roundhouse foreman for a month to get him to "turn his driving boxes around;" for what reason I have been at a loss to find out, and I made up my mind not to show my ignorance by asking. It looks to me as if THE LOCOMOTIVE ENGINEER was the place for us firemen to go and find out for sure Can you help me out? *A*. Most shops make driving boxes $\frac{1}{16}$ or $\frac{1}{8}$ thicker on one side than the other, and when the outside of box and inside of hub of wheel get considerably worn—so that the engine has too much lateral motion—the boxes are taken out and turned around, thus taking up the wear.

(3) Engineer, Aurora, Ill., writes:

Last fall I visited the West and rode over part of the Denver, South Park & Pacific road on a little narrow gauge tank engine, that for "go" and work beat anything I ever saw. I noticed that in rounding a very sharp curve the engine would miss one or two exhausts, and the ones that did get out were extra loud. I have tried to think how this could happen, by wheels slipping on curve, etc, but can't figure it out in any way. *A*. You were probably riding on a Mason-Farlie engine, where the engine is pivoted under boiler, same as a truck under a car, and the tank frame and boiler strongly framed together; this class of locomotives use the Walschaert valve gear, the link being on outside and acting as a rocker arm, the reversing being done by moving the link block in link instead of the link itself, as in ordinary locomotives. These link blocks are worked by a tumbling shaft over top of boiler. You will readily see in rounding a sharp curve the elevation of the outside rail would cause the long boiler and tank frame to tip toward the inside of curve; this pulls the link block on outside of engine up to near center of link, often cutting steam entirely off, while the inside block drops down in link and gives more port opening It is the same as if you had a reverse lever for each side of the locomotive and pulled one of them back to the center or "out" and let the other down a notch or two. You are not the first man who has been stuck on a "Jim-Crow," as the boys out there call this class of engine

(4.) Beginner, Altoona, Pa., writes:

In setting up wedges on a locomotive when under steam, does it make any difference in what position the engine stands, and if there is a right way, what is it, and why? *A*. In setting up wedges always put your engine on or near the top quarter; for the



"why," see sketch. *A* is the front end of main rod, *B* the crank pin, *C* the axle, and *D* the point of contact with rail. *E F* is a line drawn through the point of contact, the axle and the pin. This line can be called a lever, *D* is the fulcrum, *C* the load, and *B* the power applied; if you pull the main rod ahead, the top of the lever is forced ahead and the axle at *C* is pressed against the front of box, and the box against shoe; this relieves the wedge, and, if there is lost motion, it can be set up easily. If you should reverse your engine and apply steam, the lever would bind the wedge and relieve the shoe, hence it is best to set tender brake and take up slack in forward motion.

(5) Construction, Kansas, writes:

I run a construction engine at the front and do all my own work. I grind in all brass cocks with coarse emery and oil, the only stuff furnished. I find that they cut the seats and themselves, and need grinding in very often. I think the emery imbedded in the brass does the mischief. Is there anything as good or better? *A*. Grindstone grit, used with oil or water, cuts about as well as emery, and washes off completely, not being sharp enough to imbed itself in the metal.

(6.) H. L. H, Harrison, N. J., writes:

I am a young fireman and notice that the drivers slip when the rail is a little wet, but stick when it is real wet. Can you tell me the reason? *A*. When the rails are but slightly wet they retain the moisture and are greasy, the moisture remaining upon face of rail with rust, oil and dirt. In a heavy rainfall the rail is washed clean by the force and larger quantity of water. It has been noticed by enginemen that rails wet from fog or mist cause the drivers to slip much more than rails wet from a direct rainfall Some roads use a strong jet of water instead of sand on grades in damp places like tunnels and coal mines.

In the Roundhouse and Repair Shop.

The Pittsburgh Locomotive and Car Works built 117 locomotives last year. These works have made many important improvements during the year.

* * *

The commissioners report that there are in the United Kingdom of Great Britain 15,400 locomotives and 528,090 "vans, wagons and vehicles" of all descriptions.

* * *

The gross earnings of the Manhattan Elevated roads for the year ending September 30, 1887, was $8,010,887. How is this for 5 cent fares and not a pound of freight?

* * *

The Brooks Locomotive Works turned out 144 engines during 1887, making a total of 1,315. Many improvements have been made in the works, that will increase the output. 16 were built in December.

* * *

THE LOCOMOTIVE ENGINEER acknowledges the receipt of a handsomely-bound and illustrated catalogue of the American Brake Company, St. Louis, Mo. The catalogue will doubtless be of service to us in answering questions about details of this brake.

* * *

Engineers, firemen, or repair shop employes who have got up any new tool, device or machine used on locomotives or in railroad shops, patented or not, should write us, giving description and sketch of same. Let your light shine; the exchange of kinks will be beneficial to all.

* * *

At the Taunton Locomotive Works they are building tanks with entire iron frames and having a deep flange around the coal pit only, the top of tank being clean and corners rounded off. It saves all shoveling down of coal and the rusting out of tank, is clean, and keeps dirt from flying in backing up.

* * *

What railroad man ever saw a brakeman stumbling along in front of a locomotive trying to keep the pilot off his heels and hold up a 150-pound draw bar to couple onto a car, without a shudder? A step of three-inch stuff, a foot or two long on each side of the pilot, would decrease this danger 1,000 per cent.

* * *

There will be no correspondence in THE LOCOMOTIVE ENGINEER of a personal nature, or lauding the paper any more than the law allows. The mechanical points will be carefully sifted out and used. It is our aim to make every article and item of this paper show up a point, or convey information valuable to locomotive enginemen.

* * *

The writer recently went over four different lines of road that were heated by steam. It was not a cold day by any means, but raw and disagreeable. The cars were poorly heated, and we noticed that at every stop the blower of the locomotive was singing its doleful song. Can it be possible that those big boilers can feel the drain of a little one-inch pipe of steam?

* * *

The *Engineer*, of London, England, has in its advertising columns a cut of quite an extensive apparatus, called a centrifugal water separator, and its use to "wring the water out of steam." How would one of these machines do on the smoke-stacks of some of our locomotives whose engineers believe in the water cure? If it wrings the water out of steam, it ought to do as much for smoke.

* * *

The Mason Regulator Company, of Boston, report that they are very much behind their orders on reducing valves for steam car heating. Among the large orders received recently are those from the following railroads: Pennsylvania, Boston & Albany, Connecticut River, Lehigh Valley, New York, Susquehanna & Western. Also from the Martin, Sewall, and Graydon car heating companies.

* * *

A good many engineers and firemen do not like the extended front and open stack for the reason that it throws out a shower of dirty water when the engine is first moved, unless handled very carefully. Some roads have a one-inch pipe tapped into the lowest point of the exhaust passage, and fitted with a taper plug cock connected with the cylinder cock rigging to open and close; this drains off most of the water and is a good idea.

* * *

Pedrick & Ayer, of Philadelphia, have printed a small slip which they enclose in their letters and shipments, in which they ask repair shop employes and engineers who have invented any new tools or appliances peculiar to railway repair shop work, or who know of anybody who has, to communicate with them, with the view to manufacturing on royalty or other satisfactory arrangement. They have lately bought ground on which they will build new and greatly enlarged shops.

* * *

The snow-plows and flangers are abroad in the land, but not as thick as usual at this time of year. While a fall of eight or ten inches in England often blockades its roads, as many feet of the beautiful on some of our Northwestern roads do not discourage the management or keep the trains from getting through in fair season. The devices for handling snow are now so perfect as to discourage travel but little in the most rigorous seasons and snow-mantled districts.

* * *

We recently went through the shops of the B. & A., at East Albany, and found everything about the place clean and neat, shops newly whitewashed and windows clean, all tools wiped up. There were twelve engines in the shop for general repairs, and were of all classes, some old Hinkleys with out domes, and pumps under cab run by a crank on the main pin; others of the latest designs. The 45-stall round-house was full of engines, and as soon as one went out another took her place. We shall have occasion to mention many labor-saving devices we saw there at another time.

* * *

This paper is in no way connected with any order or insurance scheme, but we want to say right here that it is our advice to every engineer and fireman to insure their lives at once. You are young and can get in better now than when old age creeps on. Married or single, it is a good thing. The insurance systems of the two great Brotherhoods are fine examples of what men can do for themselves and their families. If you do not belong now, and can do not put it off. We wish the round-house and repair shop men had half as good a system; they ought to try and organize.

* * *

Engineers running locomotives with open cabs, common eight wheelers, know what a nuisance the opening of the fire door is. The light blinds a man so that it is almost impossible to see ahead. The writer saw a nice little device on a Boston and Albany passenger engine, that made him wonder why he never thought of it himself, and that was a shield of sheet metal about one foot square, soldered onto the gauge cock dripper in such a way as to keep the glare from the open furnace from the engineer's eyes. It costs nothing, is not in the way, and must be a great relief at night.

* * *

At the Rhode Island Locomotive Works, a number of new engines are being built that are lagged all over boiler and dome with an asbestos mortar that is easily applied and makes the job all one piece. The preparation is put on while the boiler is under steam, and a couple of days are needed to apply it properly. It is claimed that it is not necessary to remove it when the engine goes into the shop, as the least leak is shown through it, and a piece can be cut out, the leak repaired and replastered. It cannot fail to be a better job than wood, and is fire-proof.

* * *

On a recent visit to a railroad blacksmith shop, the foreman pointed out two steam hammers at work and said: "Now there are two hammers, by two different makers, just the same size, yet this one on the right will do a great deal the most work, not because it is faster, but just on account of the design of that anvil base; you see, the other one is very large, and has a big hoop close up to the anvil proper. We have no end of trouble to do anything on it that is very crooked, or has legs or arms to it. Now the other one has as much surface on the ground, but is long and narrow at the anvil; we can stick the pedestals of a big frame over that one and get the anvil in the corner for a top blow." This is a point that makers might well look into when tools are to be used in a repair shop.

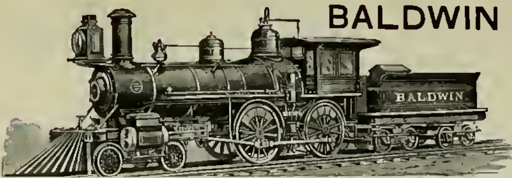
* * *

There has been a number of slight accidents and runaways in cold parts of this country by air pipes about the engine freezing up; this is especially true of such locomotives as carry the air drum at rear or on top of tank. Drip cocks are provided, but are not always in the right place. The drum and pipes should be carefully blown out every trip, and greater care used in keeping air pump properly packed in winter than summer.

Steam and water coming from packing gland on steam cylinder is sucked in at air gland. A ring or "necktie" of three or four strands of wicking tied closely around the piston rod will catch a great deal of this water and send it outside of the gland instead of down around piston. Do not use too much oil in air cylinder; use a thin well oil, and not very often.

* * *

Employes of locomotive repair shops do not need to be told to what an extent bushings are used in repairing locomotives, especially the link gear. There are about as many different ways of making bushings as there are shops making them. Some use steel and temper them; some bronze, a few cast iron, but most of them use wrought iron and case-harden them. This is the cheapest, as a rule, and the hardening is easily drawn to rebore, etc. The different processes of making and finishing bushings are expensive and slow. Bushings for locomotive work seems a small thing to make a specialty of, but John S. Leng, of this city, has put upon the market a series of these bushings of seamless, cold drawn, steel tubes, made to such nicety as to size, that no turning is required on the outside, and the inside merely needs grinding out same as any bushing. These bushings will take a slight temper and can be case-hardened.



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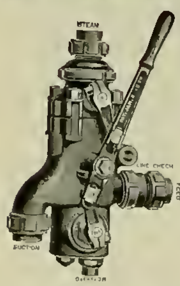

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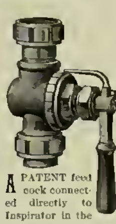

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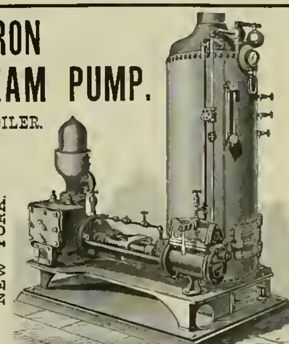

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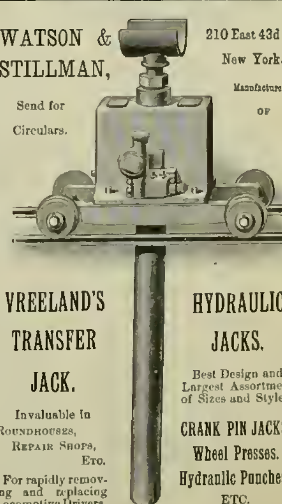

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The Silvey Electric Headlight.

We illustrate herewith the lamp and reflector of a new electric headlight recently perfected and put on the market by the Silvey Electric Co., of Lima, O. The difficulty with former attempts to u e electricity for headlights has been that the constant jar of the locomotive disarranged the feeding mechanism of the carbons, made a flickering light, and one that could not be relied upon; many of the earlier kinds were also too complicated for care of engineers. In the headlight here shown the common reflector is used; behind this is an iron upright, on which slides the two carbon holders; these are fed toward each other by the right and left hand screw, shown immediately back of upright; this screw is worked by the ratchet wheel and dog shown at base, and is regulated entirely by the current—no hand manipulation being necessary after the carbons are once adjusted. The current is furnished by a small combined engine and dynamo on one base and under one cover, the complete machine occupying a space of three feet by fourteen inches and eighteen inches high; it is placed in any convenient place on the locomotive; preferably on left running board, in front of cab. The light has had a very severe trial for some months on a switch engine, and has given satisfaction. The feed being a solid screw, and positive, the lamp will burn as well on its side, or upside down as in any position.

Fancy Penmanship on Train Orders.

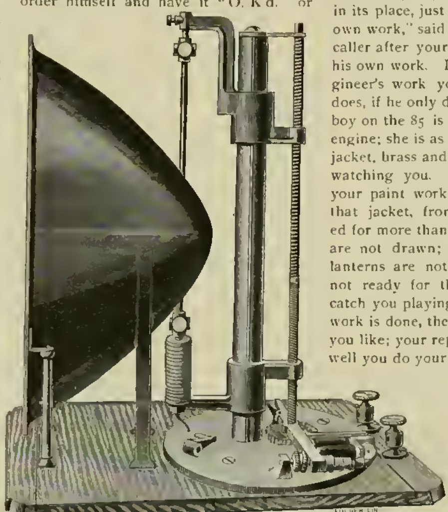
Just about once in so often the "press" of the country record a fatal calamity resulting from a misunderstanding of train orders.

Train orders, as a rule, are not carefully enough read. Train orders are not carefully enough written. A fatal collision recently occurred where the conductor read Somersett for Summit. This may have been caused by poor or fancy penmanship, or poorer attention in reading. Many operators try to see how many flourishes and how much fringe they can work on to a train order, and the idea should be sat down on by train men.

The writer was one of the star performers in a little circus of high and lofty tumblers caused by an operator giving an order where "*2nd* section number 29" was made to look like "*and* number 29." First 29 was the ringmaster that made all hands hunt for plowed ground.

Too much care in writing and reading train orders cannot be used.

The writer has often thought that some system of orders where the conductor or engineer had to write the body of the order himself and have it "O. K'd." or



NEW ELECTRIC HEADLIGHT.

"Corrected" by the operator would prevent mistakes in reading and understanding orders. Its greatest disadvantage would be that it is a slower process than that now in use.

There are now in successful operation several systems of receiving and sending telegrams on moving trains, and in this case the order received could be written by the conductor if necessary.

Mistakes and blunders in this line are calling for many victims per year, and means should at once be taken to cut down the death-roll.

A Fireman's Lesson.

On a recent trip through a roundhouse with the master mechanic in charge, we came to a man busy cleaning the headlight.

"Where is your engineer?" asked the M. M.

"He said he wouldn't be down to-day," answered the fireman.

"Well, you put that reflector right back in its place, just as it is, and go at your own work," said the M. M. "I'll send the caller after your engineer, and let him do his own work. I don't care how much engineer's work you or any other fireman does, if he only does his own first. That boy on the 85 is packing, but look at his engine; she is as bright as a dollar, paint, jacket, brass and front end. I have been watching you. You have not cleaned your paint work for a month. Look at that jacket, front end, stack not painted for more than a week. Your supplies are not drawn; your signal lamps and lanterns are not filled; in short, you are not ready for the road. Don't let me catch you playing engineer till your own work is done, then do as much of his as you like; your reputation depends on how well you do your own work, not the engineer's." Don't wait for your M. M. to say this to you before you tumble.

Boiler washers can save lots of trouble on the road by a little care in washing out. Where there is lots of scale, and especially where fire boxes are above frame, deposits of mud and scale in driving boxes and eccentrics are an element of danger. A little care—a piece of sheet iron or an old piece of gunny sack under a wash-out hole, would be a great improvement over the rough-and-ready methods so commonly used.

If your fireman wants to clean the paint, jacket or bell, or paint the stack, while running down grades, do not allow it unless something out of the general run is going on. It is a dangerous practice in more ways than one.

Buying Polishing Material.

We find that there are hundreds of firemen on many roads throughout the country that are buying and paying for, out of their own pockets, certain kinds of polishing material that will do better work with less hard labor than the crude cleaning materials usually furnished.

Railroads can buy the best of cleaning compounds, in bulk, very cheaply, and if they have firemen that are willing to keep their engines clean by paying more for it at retail, they would doubtless keep them cleaner if furnished with more dope at no cost to them but their labor. It would be just as fair to expect the company to buy the fireman's clothes, as for the fireman to purchase needed supplies for the company.

Purchasing agents would serve the interests of their companies to find out what cleaning compounds are so badly wanted by firemen and supply them.

How Shall They Die?

Firemen who take great pride in keeping the brass, paint and windows in the interior of their cabs clean, are just now deeply interested in the discussions going on as to the best mode of executing criminals, in the hope that roundhouse men who fire up locomotives and keep the door half open to smoke up everything, will soon come under the head of those in immediate danger. So far as heard from, the boys seem to prefer something slow and lingering.

Comfort Wanted.

Consolidation engines, as a rule, have very poor seats for engineers and firemen. They are hung on side of cab like a table leaf, and cannot be cushioned too heavily without being in the way while down. Consolidators usually have small wheels, and do not ride any too easy. Some men put a coil spring on the foot rod that holds seat up, this helps; others put a small leaf spring on side of cab also—this hurts. A man naturally leans out of the window when sitting down, and when the seat tries to absorb some of the "lift" it jumps up and down and tries to tear a man in two at the third rib, as his shoulder is firmly braced on the arm rest. A simple spring seat that carries the arm rest with it would let a man "teter" a little and not break his back.

The Half-Notch.

Many engines are now being built with the May style of double-latch reverse lever; this admits of very close regulation. The old idea of arranging a quadrant to cut off at a certain number of inches was generally superseded by quadrants cut as full of notches as possible; then thinking engineers began to put the handle of a set screw wrench in the notch and let the reverse lever rest against it; then they got to making a regular little piece to put in the notch, and then came the double latch that makes it possible to work *between* the close-cut notches. The best results in stationary engine practice are obtained by automatic engines whose governors control the point of cut off instead of throttling the steam. In a locomotive the engineer is the governor, and that he should get better results by handling the reverse lever than the throttle is but natural.

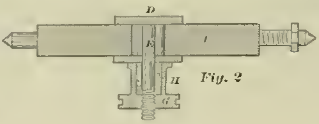


Fig. 2

Driving-Box Center.

By Hiram R. Jones.

This device is very convenient for getting the center of a driving box. The steel points A and B, Fig. 3, are firmly set against one side of the bore of the box by screwing the set screw C against the opposite side. This gives a bearing at three points, and holds the body of the tool very firmly in its place.

A fine center D is made on the flat head of the steel bolt E. The hole through the body F is one-half an inch larger than the stem of the flat-headed bolt, so as to allow a lateral adjustment of the same. It is held fast by the milled thumb-nut G. By loosening the grip of this nut a very little, the tension of the spring H will maintain sufficient friction on the head of bolt so that it will not slip of itself, but will allow the center mark to be adjusted by a slight touch of the finger. When the adjustment is complete the nut is screwed tight.

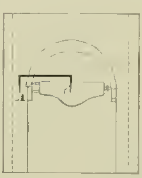


Fig. 1

In connection with this, I have found that a rigid tram made of ¼ inch round steel and six inches between points, to be very handy to transfer the center to face of box as at A, Fig. 1.

This tram has the advantage of being a known distance; is always the same; does not have to be set, and will not change as will a pair of dividers. When the point A is established, it may be used thereafter and measurements taken from it when center is removed from the box.

Fig. 3

A Handy Injector Kink.

Many roads have adopted some means whereby the engineer could use both injectors from his own side of the cab. Some use a non-lifting instrument on the left side, and put the throttle and lazy cock on the right; others put two non-lifters on the right side; and still another scheme is to use two lifting injectors, one in front of engineer (where boiler comes through cab), and the other across boiler head. Any of these arrangements prevents the fireman from operating the instrument, and would call for an entire remodeling of pipe fittings where it is desired to make the change on engines already in service. On the Lehigh Valley road they have the best arrangement we have yet seen. There they use only injectors or inspirators that are operated by one lever, and one is placed on the left side of cab, as usual; to the handle is attached a short rod, the other end being jointed to a lever which is fulcrumed to top of boiler and terminates in a handle convenient to engineer. By pushing this lever ahead, the left injector is started from the right side, and the fireman can use it from his side just as well. It is cheap, handy and efficient.

Headlight Dope.

An old engineer told the writer the other day that he had used for years a headlight dope of his own. He has a bottle of alcohol and lampblack mixed about as thick as paint. He wipes the reflector out with a coating of this and the alcohol instantly dries, leaving the lampblack in splendid shape to polish with. He does this with the reflector in lamp, and does not take it out to clean more than once in three months. It is worth trying.

The Spring Automatic.

Another railroader has been educating the public (?) by telling a Chicago paper how the automatic air brake works—the air holds the brake *off*, and when the pressure is deduced the springs slap it *on*. Young mechanics and railroad men who do not actually have to use or repair this brake, believe this, without further thought.

As a matter of fact, no springs are used, except a light one to hold the brake off; the automatic principle being to store air on each car in a small drum, connected to the brake cylinder by a pipe connected through a triple valve; this valve has a piston valve that is forced *up* when air is admitted to train pipes, and is held there, allowing the air to *pass* it and fill the drum through a small opening, and the pressure on one side balances the other, by suddenly reducing the pressure below this piston; the air above forces it down and opens communication from the drum to brake cylinder. The air does the work, not the springs.

If engines without air, or those with it, that break down on the road, should get hold of a train of spring brakes, the boys would have some fun prying the shoes away from wheels and blocking them so.

The Canadian Locomotive and Engine Co., of Kingston, Ont., built 18 locomotives during 1887, making a total of 332 manufactured by this concern.

Many Uses for Compressed Air About Railroad Shops.

Since the adoption of the air brake on most of our principal roads a small air plant has, in many cases, sprung up about each shop, for one purpose and another, generally using one or more air pumps as compressors. N. W. Sample, superintendent of motive power, of the D & R. G road at Denver, Colo., uses it more extensively and successfully than in any place we have visited.

It is customary in these shops to use three or four pumps—generally ones just repaired are tested in this way. They are located on an iron frame in the machine shop and are run by direct connection to boilers. There are one or two air drums, same as used on the locomotives, in different places in the shop and a line of pipe is hung overhead, the entire length of shop, with pipes coming down at convenient points and provided with a globe valve and hose connections.

They have at this shop three small, plain, slide valve engines mounted on a little, truck, having four 8-inch wheels and provided with a handle to facilitate moving from place to place; these engines have a number of different sized pulleys, easily changed; and are used for many purposes; they are connected to air system by hose and exhaust into the open air. They are rigged to do all the drilling about boilers, frames, etc., and for a thousand purposes where a small, independent power is needed. Pipes and brakes are tested, dirt is blown out of planer slots and drill holes, cylinder boring machines are run, etc., and, when an engine has been rebuilt, her boiler is filled with sixty pounds of compressed air, and with this she is run out of shop and to yard without fire, smoke or dirt; at the end of the shop a hose is connected to a T in the blower pipe and the draft kept up enough to prevent smoking up cab while fire is being built

This line of pipe extends through both the roundhouses, and a pipe comes down at every post, the air being always used when firing up dead engines; it saves time and is conducive of cleanliness.

Underground pipes conduct air through the coach yard and shop and to pits in freight car repair yard using the common hose coupling; when an air brake or any of its parts are repaired, or reported out of repair, the hose is coupled and the brake tested.

The boiler shop and blacksmith shop are also amply provided with air pipes. One of the main features of the boiler shop being the drilling of holes in firebox, etc., by the air-operated engines and flexible shaft.

At another shop on the same line, a pump just repaired is connected to boiler and tried, but instead of bolting the pump to frame by bolts, the same as on a locomotive, the bolt lugs of the pump are merely hooked into properly made hooks on the frame, saving time and being amply secure for testing purposes.

At the N. Y., L. E. & W shops at Jersey City, they put up the pumps to test, but bolt to a frame. They have an engineers' brake valve, auxiliary air drum, and a brake cylinder connected. Here the road men can go and practice handling the brake, and, having the entire equipment under the eye, can see just what results are obtained by a certain manipulation of the engineers' valve.

Such plants are very inexpensive, and of inestimable value to a shop.

High Locomotives.

We have received several letters from enginemen, on both sides of the cab, asking for an explanation of the advantages, disadvantages, safety or dangerous features of locomotives with high centers of gravity.

Locomotives with extremely high centers of gravity are of recent design and are fast coming into use.

Their principal advantage is that they ride much better than engines with low centers of gravity; they are much easier on the track, their boxes and flanges. The boiler being well up off the frame gives the designer more chance to set the proper springs, etc.; is consequently easier to oil, inspect and clean. All the disadvantages we ever heard urged against them is that "they don't look natural"—a harmless form of prejudice.

It is well known by engineers that locomotives that will "roll" generally ride better than those that will not. Engines with boilers set well up are noted for their ease in riding. When on a curve, an engine like this would "roll;" the boiler and frame, being the greatest weight, would resist the pull of the wheel flanges and try to keep on in a straight line, but the wheels, held down by the weight and turned by their flanges against the curve of the rail, pulls the monster above it to one side; this causes the boiler to roll or lurch toward the outside of curve, and this roll, in a high engine, is transmitted by way of the springs in a more nearly *downward* motion on to the boxes of the wheels. The shock is on the springs and on the box in such a way that they can move up and down in the jaws of the frame. Now in a locomotive with a low center of gravity, and under the same circumstances, the shock from contact of flanges with rail at a curve would be received more on the *side* of the driving box, the weight of the boiler, being low, acting as an immense hammer on the box and flange. Heavy engines with low centers of gravity often break axles from this cause alone. It is easy to see that when a blow is absorbed by a system of springs it must be much easier on boxes, flanges, track and men than one that strikes from the shoulder.

Not You.

There are over 6,000,000 people in the United States who can neither read nor write; over a quarter of a million of them in the State of New York. We believe there are very few men on locomotives who cannot read, and hope the few, if there are any, will be all gone before another issue of this paper makes its appearance. Men cannot run locomotives in road service who do not read, and we hope that if there is a fireman in this broad land who cannot read, that he will speedily learn. Any man who will try can learn to read ordinary newspaper print and to write his own name in two to four weeks by devoting an hour or so a day to it. There is no possible excuse for a young man to not be able to read. False pride may prevent, but real pride ought to overcome the false. There is no confession more humbling than that of illiteracy. Go to any one you know, old or young, rich or poor, male or female, make your confession and state your determination to get out of the dark and ask for a start—you will not be refused once in five thousand times. If you were pitched into the sea you would try to swim; you are in a sea of darkness—swim.

A Better Way.

On a recent visit to a railway repair shop we saw a large mogul engine jacked up, and several mechanics were at work fitting up driving boxes, shoes and wedges. When a wedge or shoe was fitted and found all right, it was held in place by a common cast iron clamp around the frame, and when a driving box was fitted, it was tied up to frame by a piece of rope. A better way to hold driving boxes is to bend a piece of ¾ round iron in the shape of a staple and let one leg rest on top of frame and the other support the box by hooking under the brass. They are not in the way of the centers and are easily put in or removed. A very neat device to hold shoes or wedges is made by making a T-headed bolt, threaded on the long shank, and with the cross-head wide enough to cross the shoe and have a slight projection on each end to prevent it from turning; run a common nut loosely on the long shank and slip the bolt into a short piece of gas pipe. A few turns on the nut against the pipe holds both shoe and wedge, with no projections in the way of other work.

A Coal Hopper.

A chute, about as high as the bottom of fire door, and about as wide, extending from boiler head back about three feet, is a new idea on coal burning engines. The bottom of chute is sloping enough to allow all pieces of coal that are dropped to slide into the furnace. The door is placed as low as possible. We understand the idea was gotten up to prevent the necessity of raising the door where wood burners were changed to coal burners. We fear, if obliged to fire one of these mills for the first time, we should be apt to aim high for fear of our knuckles.

Baldwin Locomotive Works have recently built engines with as much as 44,000 pounds on the front trucks — almost enough traction wasted here to employ another pair of cylinders.

Not a Safety Valve.

Not long since the writer was waiting for a train at an Eastern city, and naturally drifted out into the yard, where there were a number of locomotives standing.

It was quiet and three or four engine crews were gathered around a U.P. car provided with the automatic air freight brake. This brake is provided with a ten pound pressure valve, set on top of a ½ inch pipe and fastened to the end of car about four inches from the roof. There was no one in the crowd who knew what its exact use was; the firemen crawled under the car and examined it and climbed up the ladder and looked at the little brass valve, turned the cock a few times and talked about it. The engineers said nothing and looked wise. Finally one of the firemen exclaimed, "Here comes Uncle Tom, he'll know!" Uncle Tom climbed down off a passenger engine and came over to the crowd and was at once asked about the "pesky little cock on the end of that long pipe?" Uncle Tom took a look, changed the quid of weed to his other cheek, and remarked, "Why that is a safety valve to keep some of these young, reckless bucks from skidding wheels with the automatic!" The other young engineers looked at the firemen with an "I told you so" gaze, when they had not said a word about it, and all hands seemed perfectly satisfied with the explanation.

Uncle Tom was off his base. Now we want to kill two birds with one stone, etc. In the first place there are too many Uncle Toms whose word is accepted on all such subjects. Second, it is harder to un-learn a thing learned wrong than it is to learn right in the first place.

Uncle Tom has had experience and is talkative, but has been busy and getting old, and the business of railroading being young, in comparison, has got ahead of him.

The great developments and improvements in railroading have not all been made on one road, at one time, or in one place. Uncle Tom has not traveled enough to "keep up," nor could he if he tried. He would be spread out too thin. Good papers devoted to special branches of railroading have a corps of men, each keeping up a certain department, and if they should answer such a question as Uncle Tom did, in the way he did, they would be held up to the world and laughed at by a hundred other papers; hence they are careful. Refer such questions to good papers in your line, then discuss their answers and you will soon be well posted and posted right.

Now that ten pound pressure valve will not keep you from "skidding" wheels at all; it is merely a valve having a weight on top and attached to the exhaust passage of the triple valve under the car. It is used on long, heavy, mountain grades. It is well known that to re-charge the auxiliary cylinders under the cars it is necessary to release the brake; on such grades the train often gets beyond control on this account. To prevent this the valve mentioned is used. Ordinarily this valve is "cut out" and the brake releases into the air, but on a grade the brakemen run along over the train and "cut in" a few of these valves and the valve keeps a pressure of ten pounds in the brake cylinder, and the auxiliary is then re-charged easily. Of course on ordinary grades this is not used, and at a station, etc., would prevent the train from being moved. It is a safety valve coming down, but not a safety valve going up.

Handy Crane for Locomotive Repair Shops.

At the Worthington Hydraulic Works, Brooklyn, we noticed several handy, cheaply-made lifts that struck us as being the very thing for roundhouse and railroad repair shops. The device was simply a piece of common brass pipe four to six inches in diameter and as long as lift required; they have a head screwed on top with a ring in it to suspend them by, and drilled to admit air; the bottom head is provided with a packing gland through which works the piston rod; this has a leather packed piston head on one end and a simple hook on the other; it is operated in some cases by water and in others by compressed air. When suspended over a lathe on a track allowing for movement across and in the direction of the length of the lathe they are a very handy crane. It makes no difference where the load is, as the piston cannot be cramped out of line with the cylinder.

At Worthington's they handle the flasks in the foundry by one of these cranes on a traveling frame; it is worked by air, and is very quick and accurately handled; the hose supplying it runs over pulleys, and has a loop that takes up slack hose by a weighted pulley.

There is scarcely a railroad shop in the country where they do not have air or water pressure, and one of these simple contrivances can be easily made by any mechanic, and would be just the thing around a roundhouse to remove locomotive stacks, cabs, etc. They can be used in any position, vertical, horizontal or at any angle, and a man can shoulder one and carry it any place. They were designed by Mr. Flynn, general foreman of the Worthington works.

Brained, Yet Alive.

Do you see that big fat engineer over there? Does he look like he had his brains knocked out? Hardly. Well, you ought to hear him tell about it, but he won't do it if you ask him, so I will give you the story as he told it to me. It was a long time ago, when he was firing on a new road in one of the Middle States. One night as they pitched over a long hill he took the big tallow pot and went out on the running board to oil the valves—that was before the time of inside oilers. I suppose he was a little sleepy, and, being used to the work, a little careless, and the result was that he walked off the end of the footboard and went headlong into a sandy cut. The engineer missed him in a few minutes, as he did not come around to oil the right valve, and stopped. As the train was running very fast they had no idea but that the poor fireman was dead as a clam. When our fat friend struck *terra firma* he woke up, rolled over a few times, and finally found himself in a sitting posture in the ditch. He says he was dazed, and hardly knew what had happened yet, but feeling something warm running down his face and neck he thought to himself, "it must be blood; I am badly hurt." Says he felt no pain. Then he put up his hand and felt for the wound—it was bright moonlight—and, as he brought his hand down in front of his eyes, he saw that the clotted stuff upon it was white instead of red. "It is my brains," he said to himself, "and I am a dead man." He said then he saw the lights of the train coming back for him, and wondered if he would live till they got there. They found him seated so, and kind hands lifted him tenderly into the baggage car. With a trembling voice he gave the engineer a message for his mother and a certain girl that lived three doors west of his home, and bid his old friend good-bye. About this time a small man elbowed his way through the crowd, and the conductor said: "Here is a doctor." "Bring a good light," said the new master of ceremonies. It came, and the doctor commenced to feel of the victim's legs, arms and shoulder blades. "I'm all right except my head," said Fatty. The man of pills run his fingers lightly through the clotted mass on the bushy head and said: "The skull is not fractured; why, this is grease—tallow." Well, then that engineer just let out one war whoop and went into hysterics, and everybody laughed till our fleshy friend got mad and broke out of the crowd and went to the engine. It seems that when he fell, the tallow-pot, as usual, fell on top, and from that day to this he has gone by the name of "Tallow-pot."

Getting Left.

Where engines run, "first in first out," it is a very good and safe scheme to go home and go to bed as soon as in, even if you can figure that you won't get out for twenty-four hours or more—you may get fooled; other engines ahead of you may not be repaired in time, accidents may happen to others going out, men may be sick, and before you have closed your eyes the caller may be after you. Don't get left. Sleep first.

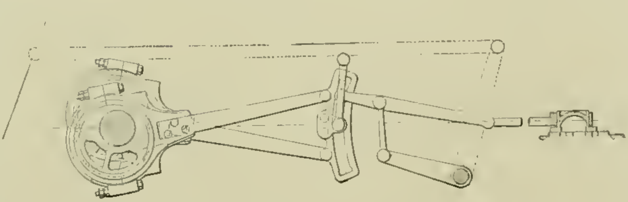
In riding over several lines of road during the month we failed to strike any cars so well heated as those on the Reading road. They use a common stove hung under the car.

Art Critics on the Locomotive.

Sometimes it is comical to hear criticisms on road matters in a roundhouse, and sometimes the most critical of the critics learn a thing or two on little matters which they before thought they knew about all there was worth knowing.

Sometime since the writer was an interested listener to some rather severe and comical remarks about a large, colored advertising picture of a locomotive. The boys poked fun at the artist's arrangement of parts in cab, when really we have rode on and run locomotives arranged much worse. One young man pointed out the fact that the link was curved toward the front end instead of back, and then the laugh on the artist was long and loud, but was suddenly checked by the discovery that the branch pipe from pump entered the smoke arch instead of the side of boiler. Then you ought to have heard the comments. About this time an old-time engineer came in to register, and the boys pointed out the paper engine with the links "crooked the wrong way." The old man glanced at it and remarked that it was all right, and told them all to look again. They did, but nothing was right as far as they could see. "Where is the rocker box?" asked the old man. They laughed again; the picture showed no rocker arm. The old engineer told the boys he had run engines like that, and drew on the bulletin board a rough sketch something like the one below, and said:

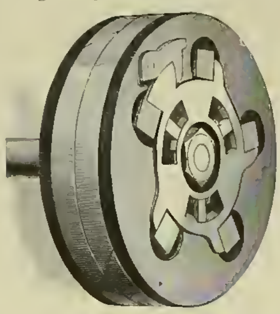
"Boys, that is a direct-motion engine. Do you see the top of link hanger is pivoted to the frame instead of arms of tumbling shaft, and the block is moved in the link instead of the link over the block; the link, of course, is curved the other way, and its radius is as a part of a circle drawn from the joint in valve rod to center of link. The tumbling shaft arms are connected by hangers directly to valve rod." The boys said no more about link, and the old-timer gathered up his dinner-pail and a roll of dirty overclothes and said: "As for that check on side of smoke arch, you have only to go over the other side of the creek and look at some of the old switch engines there; their feed pipe goes through arch and into flue sheet above flues and back about half-way to fire box, and was supposed to be a feed-water heater; you fellows want to 'cast about' a bit and pick up some different ideas than these new-fangled ones on this new road; study up, and when you 'get stuck' come to the old man and—lend me a chew of the golden leaf!" The weed was produced, sampled, and the boys gathered around the stove and told lies about fast runs their mills had made, and the aged educator buttoned up his corduroy coat and waded out into the snow.



DIRECT MOTION VALVE GEAR.

New Piston Head Bolt Lock.

The cut represents a new, novel and cheap lock for piston head bolts, the invention of Jos. Wormald, Missoula, Montana Territory. It is made of iron or brass, generally the latter; it is cast and



needs no finish whatever, not even filing up.

It is held in place by the three bevel-headed bolts, which are cast on the follower head of new pistons and tapped into old ones; the hook is driven in and keeps lock plate tight against bolt heads. It takes up no room—engines using it having the same clearance as before. It is very handy, needing no special tools to apply or release it—can be done in two minutes with a soft hammer.

It is in extended use on the Northern Pacific R. R., and is the invention of a practical mechanic and shop foreman, whose address is given above.

Is There Any Hope?

We are in receipt of a well-written and interesting letter from a young man on one of our Western roads, who says he is a fireman and has been for over three years, is temperate and loves the work, but ends by saying:

"It is the custom to promote the oldest firemen, regardless of any other qualifications, except in a few cases. Now I do not think I have got the throttle fever at all, but I feel as if I could run an engine better than many men who have merely shoveled coal for seven or eight years and never spent a day about the shops trying to learn how the engines were made, repaired, etc, or who never read or study the business. I acknowledge that I am ambitious to be an engineer, but I want to be a first class one or not at all. Had I better go to some new country and begin again? Is there any use or any hope in staying here?"

There are many young men in the same place that our young friend finds himself. We want to give this young man the right kind of advice, and let all who find themselves in his place profit by his case.

That it would be better to remain at home there can be no doubt. Take a trip next summer, study the engines and men in other parts of the country, and you will come home better satisfied with your own lot. Keep up your reading and study of your business—it will become useful to you when you least expect it. Study your business from your own standpoint, observe closely, and above all, be so busy that you will not have time to think of those years yet to fire; do your work well on the road and keep your engine clean. Be *conspicuously useful* to your engineer and to the officers of your department. You will be promoted because you are a good fireman, not because you are a good engineer.

Watch your work and chances to improve yourself, and do not think of its results. Somebody else will be watching you.

Do not put your nose to the grindstone, but take a certain amount of enjoyment—select your pleasure as you do your clothes—it will pay better to spend $2 to see a good play than 25 cents to see a low variety show. Buy books, not all mechanical, but good, wholesome story books, entertaining and instructive. If a fine painting is on exhibition in town, take it in and let the circus go. Seek the company of ladies, and avoid that of mere females. Take needed rest as soon as you come in, and be ready to go in an emergency, and thus establish a good reputation at the roundhouse. Promote discussion on locomotive subjects among fellow firemen, and thus inform yourself and establish a reputation as an intelligent engineman among a class you will work with. If you have a room, make it a home; have a fire in it, have books, pictures, magazines, and you will soon come to seek the comforts and enjoyments of that room rather than the streets. Your life, your conduct, your abilities will soon be noticed, and promotion follow. If it comes only with age and your "turn," you will find yourself a better informed man and a better engineer. There is hope, there is a chance for earnest workers in this line. The next generation of locomotive engineers will be a better one than the present, as the present is better than the past. Strive to be near the masthead of the craft, not a mere muscle clinging to its bottom.

Many of the locomotives now being built have the entire back boiler head lagged and jacketed. It makes the cab more endurable in summer.

New Application of Tire Heater.

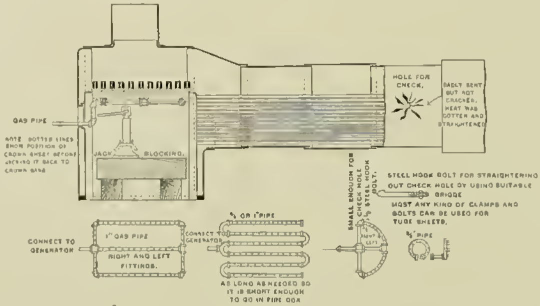
The tire-heating apparatus patented by Messrs. T. W. Gentry and G. W. O'Brien, of the Richmond and Danville Railroad, and manufactured by Pedrick & Ayer, of Philadelphia, Pa., is proving itself to be a very valuable and economical appliance for locomotive and other repair shops, where a quick and cheap heat is needed to straighten iron and steel boilers, crown sheets, tube sheets, smoke boxes, extension fronts, tanks, etc., where engines have been in collision, or crown and tube sheets sprung, from burning or other causes. The fact that the gas for heating is so cheaply and easily generated, and safely handled, and can be conducted in ordinary gas piping of any size from ½" to 1¼", within a reasonable distance of the generator, makes it the most convenient means for getting a quick heat in any place which would be inaccessible to the ordinary charcoal pan and bellows.

The great advantage this apparatus has over all ordinary gas heating appliances is, that the jets, when lighted, will stand a pressure of 25 lbs. to 40 lbs. of superheated compressed air as a blast, and, owing to a peculiarity in the extremely rich gas generated, this air is conducted through the same pipe that takes the gas to the burners.

Every mechanic who has had a *burned* or *buckled* crown sheet, or a *sprung* tube sheet to "get back," knows what the old charcoal, or coke pans, or hearths, with their clumsy supports, and the old bellows, or even small hand bellows, are; and he also knows that after he had worked hard to get the heat where he wanted it, and was ready to strike, or jack, as the case might be, he found his fire of glowing coals, and his old irons and fire pans, etc., right in the way, and all to be moved before he could get at his work; meanwhile his heat was waning and growing beautifully less each moment. With the tire-heater attachments, it is very different. A cheap burner of any desired shape can be made of ordinary gas pipe and pipe fittings; the pipes forming the jets being simply drilled with $\frac{1}{16}$" or $\frac{3}{32}$" holes. In this manner, a square, oblong, oval, or round fire may be gotten, and by suitable bends, elbows, returns, etc., any size or shape may be given to the fire.

This jet, or series of jets, are connected to a stem, or pipe, and this in turn to the gas pipe leading to generator by a union joint placed convenient for uncoupling quickly, and a cut-off cock having been provided near at hand, the whole thing is under perfect control.

The following jobs, all familiar to repair shop men, have been successfully handled by this means of heating, viz., crown sheets of 16 x 24 and 20 x 24, locomotives with sheets 60 x 35 and 100 x 40 that have been badly burned and forced or sprung down, were heated and jacked back with hydraulic jacks to their original positions without cracking or straining. Tube sheets which have been bent in from collision were heated and pulled out to original position; smoke boxes and extension fronts, which were stove up from butting, were heated and straightened; and one job that deserves special mention, which was neatly and successfully accomplished, was restoring to its original form a portion of the barrel of a locomotive boiler of ½" Otis steel, which had been badly bent in by the *checks* having been driven back, and wrenched off in collision. So nicely was the heat gotten in the exact spot needed, that it only required the threads in the hole to be freshened up, and the new checks set as square as before the accident.



Engineers to the Front.

Under this heading some papers and magazines have been lauding the great invention (?) of a new railroad reformer who is going to put another cab on a locomotive—immediately back of the stack—and place therein a new thing, for locomotives—a pilot. The inventor describes him as "a man to study the time cards and rules and to merely think of his train rights, receive all running orders, etc. This relieves the engineer of all trouble except to look out for the manipulation of the locomotive itself; the two cabs are connected by speaking tubes, etc., etc." It is needless to say that the inventor is not a practical railroad man. There is scarcely a change that we can imagine that would be harder to make and a bigger nuisance when made than this.

Engineers are already well aware how men will advise trials on runs that they would not dare attempt themselves. How many a conductor will tell a five-act story in the telegraph office and then rush over to the engine with orders in one hand and watch in the other and ask if you "can make it" to the next station for some fast train; if you have about as many miles to go as you have minutes to go in and decline to try, he will tell you of half a dozen engineers who have made it in less time.

The pilot in his front cab would be able to figure out what the engine *ought* to do on the run, but as to what she *would* do he cannot know. It would help matters a great deal for the front engineer to bawl through the speaking tube to the back engineer, "Come on; we can make it; it is only six miles and a half, and we've got ten minutes," while the rear man was feeling for water in the lower gauge, with steam at sixty pounds, and four or five flues squirting like a fire engine.

The pilot cannot know the condition of engine, track, train, quality of fuel, abilities of firemen and a thousand other conditions that are always there and always different. It is a poor idea to divide the responsibility of command too much. In a case of this kind there would always be a fight between the pilot to make a record for speed, etc., and the engineer to not overtax his engine. The decision to "go" in a tight pinch must be decided in a second—the decision must be based on experience, knowledge of the condition of every part of the locomotive, how she steams, how the train handles, etc., as well as a thorough familiarity with every foot of the distance to be gone over, the rules governing trains under the circumstances, and the chances of success. If the front engineer and the back engineer agreed on these things through the medium of the speaking tube, the opposing train would be liable to run into them where they stood. There is time for no consultation; it must be decided in one brain and the start made before the thought has had time to get out from under the engineer's hat.

The precaution of another man on the engine to think of these things can be greatly augmented by giving the fireman an insight to orders, train rights, etc.

Make repairs on locomotives so good and so carefully that an engineer can put his head out of the cab window and care nothing for the working details of the machine under him. Let him *use* the engine knowing that she will steam, that the injectors will work, the air pump supply air, and the brakes hold, and he will have time to think of his orders and the rules and figure out his run beforehand.

Do not work him three hours for every one he sleeps; do not pay him such wages as will oblige him to chop his own firewood between runs, and we will risk the engineer alone rather than be hampered with all the pilots on earth.

The Baldwin Locomotive Works are now using a plate cast especially for the place, to mount air pumps on side of boilers. It prevents sparks and dirt from accumulating behind the pump, and, as the jacket is cut out around it, there is no place behind the pump to clean. The old wrought iron brackets were unsightly, unhandy and expensive.

Correspondence

A Boycott Raised.

I am a blacksmith and foreman of a shop on a large road, and I have always thought and said blacksmithing was too hard work and my boy should learn an easier trade; since I read John Alexander's article on fighting against nature, I have been looking around and thinking. I have twenty blacksmiths and as many helpers, most of the latter are middle-aged men and have been laborers; only one boy in the shop who wants to learn the trade. Dudes and women do not take kindly to blacksmithing; others think it hard work. There is now more need of good blacksmiths than ever, and where are they coming from? I honestly believe that in ten years from to-day a first-class machine blacksmith will be getting more pay than workmen in any other kindred trade. Only three of my men are first-class, and they are now getting fifty cents per day more than machinists. I have raised the boycott on blacksmithing; it is a hard, honest, healthy, honorable calling—my boy can be a blacksmith. If he hunts for an easy trade I shall be disappointed.

N. Y. City. ANVIL.

Some Shop and Road Kinks.

The extension smoke box, while it may have some advantages over the short box, yet it has its disadvantages; and while I have never been a friend to it, I am willing to give it its due. We used to think the old Bell stack was a great deal of trouble, it required so much beating to get the sparks out; we had a round club and a piece of 2½-inch gum hose put over it, so as not to bruise the iron too much; but it was a spark catcher, and the extension smoke box is nothing more. One of its disadvantages is the use of the baffle plate; it cannot well be dispensed with; but it throws the flame down to the joints of the steam and exhaust pipes, causing the bolts and nuts to become red-hot. I have seen them almost welded together; then the bolt expands, and the steam-pipe joint leaks. I have known cases where they have had to be tightened every trip, often causing much delay along the road. I tried a cement made of asbestos, fire clay, and cast iron borings, and put a coat three or four inches thick all around and over the joints, which answered a good purpose. It was very hard to keep the joints of spark pipe and door tight, and the least air would kindle a fire that would warp and burn everything it came in contact with; sometimes the joints between the cylinders would let air in, and had to be calked with iron cement.

Another source of trouble was the sand box; the way some of them are made, every time it rained the sand was wet, and it was not a small job to empty four or five bushels of wet sand; the trouble was, the sheet iron rim went inside the cast iron base, and as the boiler maker did not make a tight fit, water ran down the sheet iron and in the cracks at the bottom. If the sheet iron was made to fit on the outside of the casting, it would run outside, and not affect the sand. A valve in the casting at the top of sand pipe (Fig. 1) answers a good purpose, often saving the taking off of the pipes; a wire rod can be run up or down, dislodging anything that may stop them up. A few ¼-inch holes drilled in the sand box lid will let the steam out if the sand is damp, but they must be drilled up so as not to let the rain in.

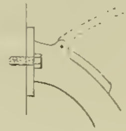


Fig. 1.

Relief valves should be on every steam chest, whether balanced valves are used or not, especially on shifting engines, where they are reversed so often; the pistons act as air pumps, and draw smoke and sparks down the exhaust pipes. A very simple valve, like Fig. 2, I used with good effect; and as it was short enough to go between steam chest and casing, a stranger would never know there was one on; six or eight holes ⅜ or ½ inch were drilled in the steam chest, leaving the center solid for the end of valve to strike against, to regulate lift of valve, and a lot of inch holes ¼ drilled in sheet iron casing opposite end of valve opening.

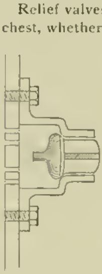


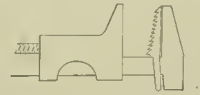
Fig. 2.

J. J. BINGLEY.

An Engineer's Kit.

Plumbers, carpenters, machinists, draftsmen and shoemakers all have a "kit" of tools, but locomotive engineers very seldom own up to one, yet even a rather poor and careless one will get a pet torch or perhaps a towel of his own.

I have got a kit. I believe all engineers should have one. I will give you a list of some of the tools in mine. I have a fine clock; it cost $20, but I would not do without it for $80. I have a good torch and a stand to put it in, a little box with soap and towel, a small mirror, a hook to keep my orders on, and a little box of tools. This contains an extra screw top for oil cups, two or three corks, a ¼ inch



rod threaded at one end and bent into a circle for a handle at the other end; this is about 8 inches long, and its use to take out the steam valves of air pumps if anything gets wrong on the road, a couple of steel wires to clean out oil holes, a scraper, a couple of small files, a small piece of emery cloth, an extra feeder for oil cups, a ball of wicking, some extra gaskets cut ready for throttle, water hose and other pipe connections, a box of matches, a screw driver, a pair of pliers, a small alligator wrench and a little steel jaw like cut, just as wide as jaw of my 15-inch wrench; by putting it into that I can handle any pipe up to 2 inches; a few assorted sizes of nails, tacks and screws. On the cab I have tacked a calendar, a tin box to hold my time card, and another to hold the coal checks. I find use for all these little things very often and find room for them all. I do not find room for the half-naked pictures of prostitutes that are so common. I do not want them in my home—the cab is my home.

Philadelphia, Pa. A KIT.

Naming Engines.

Your remarks in the January number in regard to the practice of naming engines being revived, will strike a sympathetic chord in the breasts of many persons both in and out of the railroad profession. I remember, some years since, while firing on the Hartford Division of the N. Y., N. H. & H. R. R., where all the engines were named, how passengers and others who were at the depot on the arrival of the "fast line," would descant on the relative merits of the "Adonis" and "Venus." This road formerly ran some of the most beautiful engines on this continent. The tendency now, however, is toward a plainer, though none the less sightly and certainly more serviceable locomotive. The "Arcturas," "Atlanta," "Altair," "Mercury," "Saturn," "Hercules," "Regulas," "Andromeda," and many similar names, are still familiar to the travelers over and persons living along the line and their appearance never fails to excite admiration. Mr. John Henney, the master of machinery of this system, used to derive much satisfaction from the pleasure it afforded his wife, in being allowed to select names for the new engines he built. Let the old custom be put into effect again is the wish of more than besides

"RED BIRD."

The Oily Engineer.

I was interested in an item in your first number on "the oil fiend," as it reminded me of one of the runners I know. He was an oil fiend in the fullest sense of the word—never thought a cup or box had enough oil till it run over. He used to say he would rather waste a little oil than take chances. Oil was his cure for everything—he even put it in the pop or safety valves.

He often came in off the road and said his engine was played out; wouldn't "mind her throttle," "something wrong with her eccentrics," etc.; it was lots of trouble to us roundhouse men until we found out that the eccentrics were all O. K., and that our oily engineer used valve oil and tallow as he did engine oil. We found the exhaust nozzles so badly stopped up by burned oil that the engine could not do her work on account of back pressure. After we got used to the man we always opened the smoke arch door to set his eccentrics, as we generally found one of them stuck in the nozzles (so to speak). A new wiper once remarked to me: "This engineer is going to run her all winter, ain't he?" I said I did not know and asked why he thought so. "He has oil enough on her to last to spring," answered the green hand. I always noticed that these wholesale oilers need more repairs than men who are careful about oil—I guess if a man is careful about one thing he is careful about them all.

ROUNDHOUSE.

Broom Straw Feeders.

I run a very heavy "hog" and for hot pins she was a caution, for about four months. If her pins let up on me for a day, her crossheads would commence. The side rods had common brass cups with wool feeders, the main rods had Dreyfus' plunger cups and the crossheads needle feeders. I changed cups, oil and habbitt, to no purpose; one day the pins would get hot in five miles of a run and the cups would be full of oil; the next day they would get just as hot in the same distance and the cups would be empty; one time I would take out a cup and the plunger would be free, the next time it would be stuck—I got tired. I came to the conclusion that a single small grain of sand would wedge in beside the wire plunger and stick it; the heat from pin expanded the cup and pin different, and that might stick it; the oil was thinner when hot and run through faster, etc.

When I got in I had one cup taken out and a small pipe soldered into it and coming up within a quarter of an inch of the screw cap; this pipe I filled with common broom straws. They do not work in the cup and never stick; they are not affected by the heat or cold; they are easily changed to feed, more or less, by taking out or inserting a straw or two; they catch all the dirt; the oil cannot run out when the engine stands still; they cost nothing; the feeder merely carries down oil thrown upon it. I have them in every cup, on rods and crosshead, and I would not trade them for all the fancy cups on earth. I took out all the screw tops on my cups that required a wrench and put in those with a taper thread and milled heads. I can take any of them off without a ton of monkey wrenches, and they never jar loose.

JOHN REYNOLDS.

Kansas City, Mo.

Packing Hooks.

When Watt and Trevethick and some of those old builders of the first species of steam engine got up hemp packing rings on the piston head and hemp filled boxes on the piston rods, it was thought a great invention. The trouble with the thing was the packing wore and burned out; now in those days steam engines using twenty-five and thirty pounds of steam were called "high pressure," and a piston speed of one to two hundred feet per minute was lightning. Hemp packing did very well then. Iron rings soon exiled it from the piston head, but a lingering delight in a few relics of barbarism has kept up its use for piston rods and valve stems great enough to drain the market till rope-makers had to get out iron ropes and paper strings.

When the first hemp-stuffed box commenced to "blow" and send up a cloud of steam and a few dark flakes of chewed hemp at every exhaust, history tells us that Watt or Duesenberry or What's-his-name tried to repack it, and found that the hemp had burned on to the casting of the stuffing box. The herein-before-mentioned inventor then sat down on the oaken gudgeon of a slippery-elm connecting rod and scratched his head; twenty minutes later he was out in the "smithy" pounding a piece of small iron; thirty-four minutes later he was sitting straddle of the piston rod of that engine, digging out mortified hemp with a modern packing hook.

About 2,000 engine builders are still making stuffing boxes like What's-his-name made, and about 250,000 engineers are probing after lost hemp with the same old packing hook.

There are better stuffing boxes and better packing, but if builders make miniature baling presses for hemp, engineers will keep on destroying good stuff that ought to be used to hang horse thieves and car stoves.

Locomotives with the What's-his-name's packing are a nuisance, first, last and all the time. On steamboats a great many engineers use a packing hook—so-called—that has a corkscrew on its business end, very handy and good on large work. I have found that a sharp, straight rod is better than a hook; it never breaks off; it always gets hold of something, and in prying over the piston rod or valve stem it comes in contact lengthwise, and is not so liable to scratch the rod. I will be glad when good metallic packing will allow me to take home my old packing hook and pickle it in spirits of turpentine and a long-necked bottle, as a relic of about 'steen years of sweat and profanity that are charged up to me on the silvery leafed ledger of the chief time-keeper in the great subsequently.

JOHN ALEXANDER.

Why Flues Leak.

I am a fireman and do not claim to know much about locomotives—firemen have no license to know very much—but I have been keeping my eyes open, however. Last year I fired in Texas, where the water is bad, it is bad enough so that engines only run three hundred miles before boilers are washed out. I fired for two different engineers; the first one was eternally having his flues calked, and I seldom saw the engine go over the division without leaking; almost all the other engines were the same way, and I came to the conclusion that it was a hard country on boilers—and it is. Finally I got changed off on to another engine with a young engineer. The day I was marked up my old engineer remarked: "Going out with the kid, are you? Well, he's a pretty good fellow, and may make an engineer in time." I went out expecting to have a hard trip.

When I came to engine in the yard the engineer was there; we talked pleasantly till the time came to start; he was no older than myself, and had been promoted there. As we coupled on to the train he turned to me and said: "Don't think I am a crank, but I never talk when running; I am busy." I liked that.

We pulled out with a heavy train, and as soon as the engine "popped" the kid runner put on the injector; I fired carefully and the engine steamed well; I kept watch of the water in the gauge glass and it seemed to stand at one point; the kid watched it, too; I noticed on hard pulls he touched the lazy-cock handle, and when the road became level again, and the throttle had to be eased off, he eased off the lazy-cock too; we stopped for water, and side-tracked for the express; he tried his water as he shut off, had a flutter in the top gauge and solid water in the second; he let the injector work till we got in siding and shut it off, told me to open the door.

My old engineer never touches the lazy-cock; he works the injector full until glass is full, or it commences to rain, and then shuts it off; of course I have to keep a big fire when it is on full. As soon as it is shut off the pop commences to throw steam and the stack water; then I open the door to cool her down, then the fire gets low—so does the water—and on goes the "squirt"; then I have to rustle, then the flues leak.

I was with the "kid" two weeks, and the flues did not get hammered once. It is down grade for over forty miles into headquarters, and sometimes the flues would simmer all over, but not squirt. The "kid" always looked at them and said: "They will take up with a new fire; I don't want them rolled unless they squirt, it only makes them thin and weak."

I asked the boss boiler maker about it and he said he didn't see how the "kid" did his work; every other boiler was doctored a dozen times to his once; said the M. M. was speaking about it the day before.

I came to the conclusion that the "kid" will not have to wait for time to make an engineer of him. I came to the conclusion that he is one of those men who think about their work, and I found myself trying to fire better to keep up with his intelligent running, and I would have been firing for him yet if I had not been smart and coupled the engine to train for a lazy brakeman and coupled on to a pair of fingers. I will be all right before your next issue, and back with the "kid," and I will write you a letter from

TEXAS.

Baltimore, Md.

At the Lehigh Valley shops at Weatherly, Pa., they still make frames for heavy engines with jaws bolted to frame. They are extra well fitted and finished, and give no trouble at all. We were shown a frame so made that had been in constant use for twelve years without the least sign of being loose. They cost more to make, but are handier to repair.

Hogeland's Safety Jack.

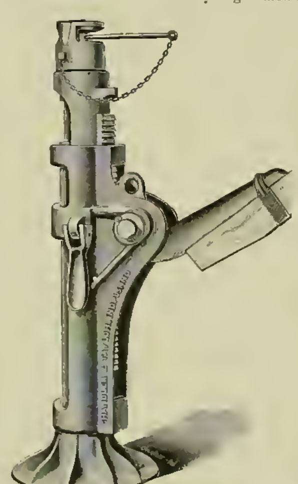
The designer of this new railroad jack aimed to combine the rapidity of movements found in the ratchet jack and the safety in sustaining loads found in hydraulic jacks.

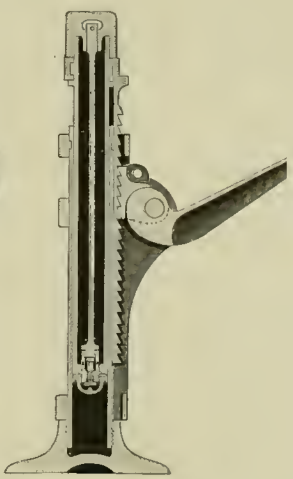
Referring to the detailed view it will be seen that the jack consists of two steel cylinders, one operating inside of the other in a manner similar to a plunger inside of a pump cylinder. The outer and larger cylinder is attached to a base of malleable iron which sustains it in an upright position. Around this cylinder, and resting on the base, is a jacket of malleable iron, to which the lever dog is pivoted. This jacket is free to revolve around the cylinder so as to permit the use of the lever from any position. To the upper end of the inner piston is attached the lifting rack, into which the lever dog operates, and by means of which the load is raised at will. The lower end of the inner cylinder is closed, and a valve inserted therein is free to open or close on the least movement of the lever being communicated to the piston. This valve can be forced open by means of a rod that is operated from the top of the jack. The object of this valve is to permit the flow of a fluid from one cylinder into the other, and thereby avoid the use of pawls.

When a load is to be raised the jack is placed under it, the lever dog thrown into contact with the lifting rack, and the valve rod turned to the *left*, leaving the valve free. A downward movement of the lever raises the plunger or inner cylinder, and causes the valve to open and the fluid to flow into the outer cylinder to supply the vacancy, and as it cannot escape back again it supports the plunger and its load until the next movement is given it; the fluid follows it and securely holds all that has been gained.

To lower the load, all that is required to be done is to disengage the lever dog and turn the valve rod to the *right*. This allows the fluid to flow into the inner cylinder, lowers the load fast or slow and releases the jack.

The jack shown has a capacity of ten tons and is built by the Indianapolis Hydraulic Jack Co., Indianapolis, Ind.





Seeing Through Other Men's Eyes.

If a man is sued by his neighbor he seeks the advice of his lawyer. If his liver is out of order he don't say a word to his lawyer, but calls in a physician. Men cannot learn law, physic and railroading all in one lifetime. A master mechanic cannot ride on engines night and day to watch the working of every kind of device used. If he tries a patent piston packing, he puts it on one or more engines run by engineers in whose common sense and judgment he can rely, and lets their verdict settle its merits and demerits. If master mechanics do not see through the eyes of their men, why do they appoint representative engineers as road foremen of engines, or traveling engineers to look after trials of new things, watch and instruct new men, order repairs on engines that they, themselves, have not seen, condemn engines, and give them advice about everything on the road? A traveling engineer is the confidential clerk of the master mechanic, and that official sees through his eyes. Some of the greatest and most successful superintendents of machinery have a general traveling engineer, and one for each division, to see, think and judge for them—and yet unthinking men often say enginemen have no influence.

Bad Cinder Slides.

Many roads, in adopting the extension front end, took any slide or opening that came up first, and worked in the shop without finding out how it would work on the road. We were on an engine recently that "got full on duty," that is, the front end got full. The boiler had a chill, the train was delayed, and the engineer and fireman mad—so were the passengers. Inquiry proved that the slide was under the front end and handled by a large screw with a brake wheel on it; a cow had got on the track and also the front end, breaking off the screw. The engineer said it was a nuisance anyway, as it could not be worked unless the engine was standing. A slide that is handled from cab by one movement of a lever, and also having the jet cock in cab, is far better than any outside arrangement, as the runner can take advantage of open road, favorable wind, etc., to "blow out."

Useless Sacrifice.

Locomotives that are so constructed that firemen are obliged to go under them to clean out ash-pans are an unnecessary and an uncalled-for element of danger. There are many legless and armless men who can testify to this; there are many graves filled with mangled victims who cannot testify at any tribunal here. No designer, builder or owner of any locomotive need tell any intelligent man, who has fired or run one, that they cannot all be arranged, at very slight expense, so that their ash-pans can be cleaned from the side. Engineers and firemen are beset by a thousand dangers, half of which are unnecessary and can be remedied. This is one of the easiest reformed. Reform it.

A New Steam Brake.

D. Clark, M. M. of the Lehigh Valley R'y at Hazelton, Pa., has adopted a new steam-driver brake of his own. It is operated by a button on footboard of cab where runner can easily reach it with his foot. It will apply brake to drivers only, to drivers and tender, or to tender alone, at will. When in use it does not interfere in any way with use of hand brake, and is very simple. The trouble with the automatic brake is, that it releases very slow and on heavy grades the train gives a jerk back before the driver brakes allow the engine to start at all. With the new brake the steam releases as well as applies the brake, and is held on till the automatic on train is fully released and the train is free, then the steam brake is thrown off and train starts easier. A gauge is attached to brake cylinder that shows the runner how much pressure he is using on drivers.

Then and Now.

There has been a big change in the morals of locomotive engineers and firemen in the past thirty years. In those early days running a locomotive was a rough and ready side experience to the shop, and the man who went out to run and could not hold his companions level in drinking bouts, etc., was not rated very high as a runner. Now, locomotive engine running has come to be a very high grade of skilled labor, and better men are required, more temperate, more intelligent, and more skillful. The future demands will be greater than now—let the best men prepare for the demand.

LOCOMOTIVE ENGINEER.

All communications relating to the business of this paper (except subscriptions) should be addressed:

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

☞ *Mailing address of Subscribers can be changed at any time. Both old and new address should be stated. Prompt notice should be given whenever papers miscarry.*

☞ *Entered at Post Office, New York, as Second Class Mail Matter.*

NEW YORK, MARCH, 1888.

CONTENTS

WE are pleased to announce that arrangements have been made with the American News Company and its wholesale branches by which copies of THE LOCOMOTIVE ENGINEER will be regularly supplied to and kept on sale by retail newsdealers in all parts of the United States and Canada. This is a convenience which is sure to be appreciated by many readers.

Pending Investigation.

Around every shop and division head quarters there are always loafing one or more engineers or firemen "pending investigation" for some slight violation of rules. Perhaps the victim lives a hundred miles away and is there on expense, earning nothing, and, perhaps, blameless. The superintendent who should do the investigating is deliberate; he knows he can get the men mad this way, and perhaps so "rattled" that their evidence will get tangled. Some roads allow half pay when the men are found blameless, but when an official has tortured men four or five days before the court martial, he generally finds all hands guilty enough to screw down on the half pay.

The laying-off system of punishment for minor offenses is a crude, inhuman, Pagan punishment. Depriving a man of the opportunity to work, increasing his expenses, running him into debt, stinting his family and making him the creature of the whim of some petty official.

There ought to be some other mode of punishment devised that at least has a little more humanity in it. Make the punishment fall on the individual, not his family. Don't contribute to the over-full ranks of idleness. Set him back and make him work harder for less pay, or something like that, but don't say: "You can't work for thirty days, that will put you behind financially so you can't catch up for a year; your old overcoat will have to do this winter, your wife won't get a new cloak, and if you don't look out your oldest boy will have to stay out of school and, maybe, after awhile you'll learn not to run off a switch."

Who will offer a remedy that is human and where the "punishment fits the crime"?

Unwilling Heroes.

It has become the style, now, for the press and public to laud the deeds of dead engineers and call them heroes and martyrs, etc., and while they live treat them with silent contempt and as nothing but greasy, ignorant laborers. Naturally engineers cling to life as much as anybody and few of them care to die just to be called a hero and have his grave covered with flowers. He had rather be treated as a man and an intelligent mechanic and receive a few flowers now.

Engineers are never dead heroes from choice; they are sacrifices on the altar of duty. It is just as natural for an engineer to do all in his power to stop in an emergency as it would be for a woman to scream under the same circumstances. It is their training. Like veterans in battle, who obey any order unflinchingly because they are used to obeying. Any engineer who has done all in his power to stop, for instance, in a collision, is very foolish to "die at his post" if he can get off. Engineers' lives are too valuable to throw away in this manner. Men become so used to emergencies that require prompt and quick action that applying brakes, reversing engine and opening sand lever is but the work of a few seconds, and is, in ninety-nine cases in a hundred, done before the engineer thinks that the first law of nature is self-preservation.

It is the years of experience that engineers get in the front of danger that makes them the factor of safety to the train that they now are. It is this training that makes them skilled mechanics of a high order. It is this training that makes it impossible to supplant the engineers of this country by any other class of men in any emergency. The engineers of this country may be depended upon to do their duty regardless of circumstances, and will be dead heroes only because there is no time to escape after that duty is performed.

A soldier who had fired his last shot would be foolish to throw down his musket and rush to death upon the bayonets of the enemy. So is an engineer, who has done all he can, foolish to refuse safety—if safety can be found.

There is a Man Looking for You.

This is the warning we would pour into the ears of all young men who are ambitious to get ahead and cannot see the rounds of the ladder from their present position. All successful business men and railroad officials are constantly on the lookout for some good, reliable, man to take off their own shoulders some of their responsibility. There are very few superintendents who are not watching their conductors, and fewer master mechanics who are not watching their engineers with a view to finding out who would be best to take some position of responsibility if a vacancy should occur. Master mechanics, roundhouse foremen and traveling engineers are watching firemen to discover the best man to promote. To every man we would say, attend to every detail of your business, study to do it better, more economical and easier, and some one else will be taking notes of your actions; they may say nothing about it, but the good is all placed to your credit.

You have been surprised before now, the men themselves have been surprised, to find a foreman or master mechanic, superintendent or train master asked to take a similar but better position, at more pay, on some distant road, that the man himself knew little about. He had never thought of seeking employment on that road, but had been attending carefully to the details of his present job—there was a man hunting for him. He had an important place to fill and he wanted to put in a practical man who knew and studied the details of that business, and when at last he found him in Maine, he opened a higher position for him in Oregon. Do not hunt for the man with the position to give—you will lose him in the crowd. Make every action of your life and work so suspicious of honest endeavor to be an expert at your business, that the man hunter will find you by your acts, your record or your words.

If you have new or different ideas of economy in running, firing, or repairing engines, or of making or using tools, think out the details of your scheme, look at it from all sides, and if you think it fairly novel or in any way better, let it be known; write about it—you may make a mistake; who has not? You may call out pointed criticisms, but you will be learning something, and the man on the watch will count you as a thinking man and ask for your pedigree of results—if they are fair he will ask for you.

Guarding Against the Unforeseen.

This is the engineer's first great duty on the road. This is the duty that keeps his eye riveted to the track ahead, noting every signal and every sign. This is the duty that makes the fireman keep an extra lighted lantern ready for use in case of trouble. It is this duty that makes the careful engineer inspect his locomotive every trip to see if any single bolt or screw shows any sign of weakness. This is the duty that calls for lunch pails as big as a boarding-house—there *might* be a snow blockade or a burned bridge. It is this uncertainty of what will turn up next that makes an engineer's life the nerve-straining one it is. A man walking over the road may expect to find different conditions, but he can stop in a single step and the risk is only to himself; an engineer cannot stop for a considerable distance, he is going at a rate of speed that is moderate if all is well, and dangerous if anything is wrong; and a hundred lives, instead of one, are in his keeping, and depending upon his instant ability to cope with any emergency that may turn up. These emergencies are turning up many times a day to every engineer, and that so few signals are disregarded and so few fatal accidents happen from this cause speaks well for the careful guard kept on every detail and the ability of the men in charge to guard against the unforeseen.

Useless Discussion.

We are in receipt of a somewhat lengthy but well written communication from a machinist who takes exceptions to our article on the "Coming Man." We do not wish to shut off free discussion in these columns when the discussion can give any information or do any good, but as this article would only open an old and interminable argument between engineers and machinists, we do not publish it. The article referred to was penned to show that engineers had a great influence in the introduction of new devices or supplies. Our correspondent denies this influence, and then goes on to show that the reason they have influence is because they are organized and stand up for each other and *kick* for new devices, engineers' promotions to foremanships, etc., instead of for machinists.

The controversy about machinist runners is again opened; this has been settled long ago by most all roads promoting firemen only—we know of no good reason why a machinist would not make a good fireman, and, in time, a good engineer, provided his shop experience did not make him bigoted enough to disdain, instruction from a "cornfield engineer" with road experience only.

Of two men, equally adapted to railroad service, one from a machine shop and the other from a farm, the man from the shop ought to make an engineer before the man from the farm.

There is no more reason why a machinist "who knows how to build locomotives," as our correspondent puts it, should be competent to run one than there is reason that a sailmaker could manage a ship at sea or a blacksmith who makes picks should know how to mine coal.

Dangerous Bribery.

Loud whispers go around from time to time that railroad men, holding certain important positions, are bribed, or receive (so called) commissions, from manufacturers for getting their wares used on roads with which they are connected.

Proofs of such things are always hard to obtain, yet there may sometimes be a moral certainty that they do exist.

One thing is clear, if a manufacturer sells boiler tubes, for instance, to a railroad, not on account of their quality, but because somebody is bribed to recommend them, the bribe money comes out of the railroad company's till, in the end, as, of course, bribery, or the mere suspicion of it, stifles competition.

And this is not the worst of it. Defective boiler tubes mean defective, unreliable, and often dangerous service.

There is another inference. The roads which pay the most attention to the experience of their enginemen, and employes generally, are least likely to suffer from this cause. A manufacturer may bribe an individual, but he can hardly afford to bribe a whole railroad.

A. J. Stevens, for many years superintendent of motive power of the Southern Pacific and Central Pacific roads, died at San Francisco, Feb. 11. Mr. Stevens was a locomotive engineer for some eight or ten years, and reached his high position through regular stages of promotion.

An interesting feature of the progress that is being made by THE LOCOMOTIVE ENGINEER, is found in the number of subscriptions which are being received from superintendents of motive power, master mechanics, general managers and their chief assistants, as well as in the appreciative tone of the letters accompanying these subscriptions, and the pains some of these officials are taking to make the paper known along their lines. Repair shops and roundhouse foremen and employes are being heard from in like manner. All of this, taken in connection with the prompt recognition that the paper is receiving from engineers and firemen, goes to prove that it is rapidly realizing one of the prime objects for which it was founded—that was, to establish an open channel through all the departments of locomotive service, available for the mutually beneficial interchange of ideas and information.

ASKED & ANSWERED

(7.) W. Hartley, Milwaukee, Wis., writes: What is the Belpaire fire box? *A.* What is called the Belpaire fire box is merely the method of staying the fire box and form of boiler shell over it. The wagon top is square instead of round, and the crown bolts go straight from shell to crown sheet and the sides by straight bolts across from one side to the other.

(8.) Fireman, Slater, Mo., asks: What makes packing rings in a cylinder revolve—is it the shape of cut? I heard a roundhouse man telling a wiper that the rings were cut slanting so that they would turn and thus wear even. *A.* You had better get the roundhouse man to tell you *why* they turn; the steam going through the opening would turn the ring, perhaps, if it had any place to brace against; the "slant" is balanced by the other end of the ring. We never knew of any that did revolve.

(9.) F. S. E., Raton, N. M., asks:

How are the different sizes of injectors determined? We have almost every kind here; how is it some are numbered 16 and others 7 and 8? *A.* Injectors are numbered by the size of delivery tube—the smallest nozzle in the instrument—and are numbered to correspond to number of millimeters in diameter of this tube The only injector that has as high numbers as you mention, that we know of, is the older style of Little Giants. Locomotive injectors were then numbered ten more than others, to distinguish them from stationary injectors; 16 would be the same as 6 of other makes. The works now number same as all others.

(10.) Helper, Albany, N. Y., asks:

What is the chief advantage and disadvantage of double tube injectors or inspirators? *A.* Double, or, as they are called, double tube injectors or inspirators, deliver the feed water several degrees hotter than single tube instruments; this is their chief advantage. The hotter the water is heated the more lime will be deposited in using bad water; this is the only disadvantage we know of. All injectors, single or double, lime up ahead of the combining tube only.

(11.) G. H. E., Atlanta, Ga., asks:

Where does the air go to that is drawn in at overflow pipe of an injector? *A.* Into the boiler. What is the difference between the principle on which a non-lifting and a lifting injector works? *A.* There is no difference; the lifting features are merely auxiliaries or attachments to take the water to the injector; in a non-lifter it runs to it.

(12.) Snow Bank, St. Paul, writes:

I am a roundhouse machinist, and in repairing Baldwin locomotives I have noticed a chisel mark near center line of driving box and one corresponding nearly to it on jaw. What is its use? *A.* The mark is placed on box and frame to show the center line of axle, and its use to guide workmen in adjusting spring hangers. It is customary on some roads to adjust new engines so that mark on the box is about a quarter of an inch above the one on the frame, and as the brass in box wears away the marks approach each other, and by the time the engine is worn out, the box mark is not more than a quarter of an inch below the mark on frame. Allowing an engine to run too high or too low will affect the valve motion, especially if the engine has very short eccentric blades.

(13.) X., Minneapolis, writes:

Please state what unseats the steam valve, allowing pump to start in automatic pump governor, when air pressure falls below that required. I cannot see through it, except that *velocity* plays an important part, and velocity in this part of the world is an unknown quantity. *A.* The pump governor has a balanced steam valve, the top area, in steam space, being larger than the bottom, where seat is located; on top of this valve is a piston, and a small port allows steam to accumulate above it, and, being larger than valve, it forces it down and open, thus sending steam to the pump; above this piston is a small valve that closes upward. Above this is a diaphragm, and a coil spring holding it in position; above this diaphragm the air from main pipe is admitted. When air pressure exceeds the tension of this spring it forces the diaphragm down, opening the small valve, and allows the steam above the piston on steam valve to escape to the air, and the steam from below will force the valve up, thus closing it. If the air is reduced, the spring carries diaphragm back to position and its own spring closes the small valve, the steam entering through the small port then accumulates on top of piston and forces it down and opens steam valve. Velocity has nothing to do with it.

(14) E. B. M., The Dalles, O., writes:

Will you please explain the manner of testing boilers, and also state what is the equivalent steam pressure for 100 lb. hydraulic, in testing boilers by that means, or if there is any difference? *A.* Boilers are usually tested by hydraulic pressure, by pumping or forcing water into boiler with an injector made for that purpose. It is customary to apply from 25 to 50 per cent. more hydraulic pressure than it is expected to carry steam. The object of such tests is principally to find leaks. There is no practical difference between hydraulic and steam pressure.

IN THE ROUNDHOUSE AND REPAIR SHOP.

If Midland will send his name, will publish his article.

* * *

The C., B. & Q's new passenger engines have Belphare fire boxes.

* * *

The Strong locomotive is getting a new pair of fire boxes at the Wilkesbarre shops of the L. V. Ry. It is claimed the trouble with the old one was a badly designed seam in the combustion chamber.

* * *

The simple widening of driving brake shoes, grooved to cover flange of wheel, was a happy thought and has increased the retarding power of driver brakes and lessened the wear of tire in a wonderful degree.

* * *

The State railway council of Germany has forbidden the employment of men in railway service for more than eight hours. Something to make the limit at least eighteen in this country would be a big improvement.

* * *

On most coal roads of the East and on many New England roads, four wheels are rated as a car. This is because there are so many four-wheeled coal "jimmies" in use. We found this out by doubting an engineer's word when he said he had 170 cars in his train.

* * *

We have noticed a number of roads are putting a small headlight on back of cab. They are a very useful thing where engines are obliged to back up, and are a better marker for light engines when running ahead than small colored signal lamps carried on back of tank.

* * *

The Pennsylvania Railway's solid ended rods are well liked by the engineers on the fast runs. The boys say they rattle, but none have ever come up through the cab, as the old ones used to do. No one blames the engineer for "monkeying" with rod keys if they run hot.

* * *

At the Pennsylvania shops in Philadelphia we noticed several engines with long patches on sides of crown sheet. Inquiry developed the fact that they had some crown bars that rested at the ends on the edge of side sheets that were made to extend up above crown. It was a weak spot.

* * *

Mr. Jos. Hoefecker, M. M. of the Lehigh Valley R'y at Weatherly, Pa., uses a double truck in front of consolidation engines, and has flanges on all drivers but main pair. The road is a crooked one and has very heavy grades, but we failed to find one engine that had even touched the flange on any driving wheel.

* * *

The man who runs a locomotive has no business to drink intoxicating liquors before he goes out, or while on a run. If a man is at home and going to bed, a drink, if he feels like it, is not so dangerous. Total abstinence is the true and safe plan for any man with as much depending on his cool head and steady nerves as the locomotive engineer.

* * *

A. K. Mansfield, of 280 Broadway, this city, has invented and put on the market a very simple water crane that has provisions for relieving the extra pressure in pipe caused by sudden closing of the valve. They are returned to position and held there by springs that can be adjusted to any tension desired. One man can handle crane from tank alone.

* * *

Some of the finest locomotive castings we have ever seen are turned out at the Weatherly, Pa., shops of the L. V. R'y, Jos. Hoefecker, M. M. Cylinders and driving wheels come out as clean and smooth as the patterns. The foundry is well kept, with clean floors, clean windows, and a place for everything. This is the reason they do good work.

* * *

The antics of the French syndicate who are cornering the tin and copper markets of the world, make some of the manufacturers of journal bearings squeal. Of course railroad buyers don't like to pay any more for the brasses on account of their increased cost, and the temptation will be to use those of an inferior quality—a possibility which is of special concern to enginemen.

* * *

Steam reverse gears are in extended use on many Eastern roads. Some are simple and some very complicated. The Reading road has about as simple a one as we have seen. It uses a small reverse lever to handle the gear, a pointer telling where engine is working; to reverse, the lever is merely shoved forward or back, and, when the indicator shows where it is desired to work engine, the gear is locked there, by simply moving lever to center notch.

* * *

One of the fast line engines of the Reading road attracted quite a number of railroad men at the Ninth street station in Philadelphia recently. She had a line of pipe running all around under the water tank with a **T** over every truck box; a short piece of hose with a pipe nipple allowed the runner to cool off any box while running. Each box cover was drilled, to admit the piece of pipe; provisions were also made to irrigate the engine trucks also. This engine was one of the world renowned "dirt burners," but we noticed that her tank was full of the very best of coal.

* * *

The Lehigh Valley road has no general master mechanic. Every division M. M. builds engines to suit himself, and the road has some of the best locomotives we have seen East or West. There are more improved devices patented and invented by employes in use in the shops or on the engines than we have noticed elsewhere. If one M. M. gets out an engine that is better, or does better work than those in use, the man on the next division tries to beat him. Cheap material or inferior devices are not used under the excuse of being "standard."

* * *

All engineers know what a grand nuisance it is to have an engine troubled with the disease known as "sweating in the sand box." This is often caused by poorly dried sand, but where a sand-box cover fits tight it is very likely to occur. Sand-box covers that set up on little feet, or ribs, allow a driving storm to force water into the box. Some engineers have a "pig-tail" put in the cover or box with good results. This is a piece of ½-inch pipe screwed in and bent into a coil with open end down—steam and hot air can go out and the storm cannot blow in.

* * *

The Pennsylvania Company use an oil cup on driving boxes that is the best thing of the kind we have ever seen. It is a cast box with a hinged cover, and has three small copper pipes tapped into the bottom, one to the waste in center of box and one each to wedge and shoe; the box is fastened to spring saddle. In some cases a pipe to cab allows boxes to be oiled while running. Single pipes to boxes do not oil wedge and shoe, and the screw top cups are generally too small and too slow. The box described does not require to be touched by wrench or hand—the cover can be raised by spout of oil can.

* * *

The Reading Railway shops at the City of Brotherly Love are certainly model shops—models of filth and dirt. On a recent visit to the Ninth street roundhouse we found a number of locomotives and cars under cover, the floor was half mud, half plank, water stood in pools, scrap iron and car repairs in stacks, and smoke, steam and fog combined about the ceiling in great gobs of gloom. In one corner a group of men sat on timbers about a fire built on the ground. It is no wonder this road has got a new head to its mechanical department, and we know enough of G. W. Cushing to think the place mentioned will have a house cleaning day declared as soon as he sees it. Men working in a place like this will naturally get like the place after a while—no matter how good when they went in.

* * *

The Pennsylvania shops at Philadelphia have a small upright boiler fitted up with a set of boiler washers and testers made by the Rue Manufacturing Company, where all boilers are washed with warm water and pressure applied where wanted to test repair work. This company *double crew* all engines, and every mill is expected to make from six to ten thousand miles per month and often do make more. By washing out with hot water the boiler sheets are not cooled so much, and when filled up with hot water save lots of time in firing up. The foreman of the shops speaks very highly of the efficiency of the device, as it occupies no space and has no working parts, requires no foundation, and can be carried any place by one man; it is cheaper than any steam pump for this purpose.

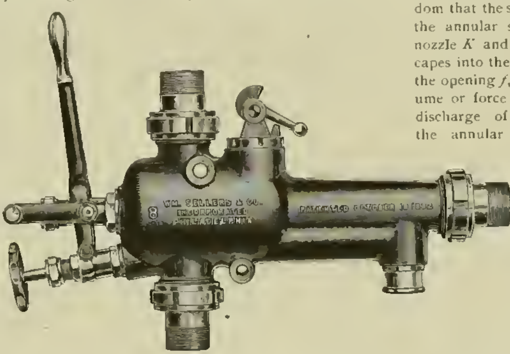
The Locomotive Engineer.

Devoted to the Special Interests of Locomotive Engineers and Firemen and to Locomotive Maintenance and Repairs.

VOL. I. NO. IV. | NEW YORK, APRIL, 1888. | $1.00 per Year, or 10c. a copy.

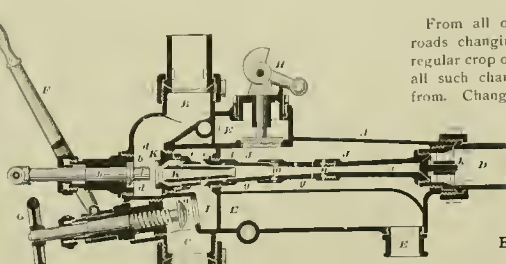
New Re-Starting Injector.

The accompanying cuts show the form and details of a new injector just brought out by Wm. Sellers & Co., Incorporated, Philadelphia, Pa. It is very handy, being started and stopped by simply pulling out or pushing in the lever.



Referring to the sectional cut, it will be seen that this injector consists of a case *A* provided with a steam inlet *B*, a water inlet *C*, an outlet *D* through which the water is conveyed to the boiler, an overflow opening *E*, a lever *F* by which to admit steam, start and stop its working, a hand wheel *G* to regulate the supply of water, and an eccentric lever *H* to close the waste valve when it is desired to make a heater of the injector. The operation of the injector is as follows:

The water inlet *C* being in communication with the water supply, the valve *a* is opened, to allow the water to enter the chamber *I*. Steam is admitted to the chamber *B*, and the lever *F* is drawn out to lift the valve *b* from its seat and permit the steam to enter the annular lifting steam nozzle *c* through the holes *d d*. The steam issuing from this nozzle passes through the annular combining tube *e* and escapes from the instrument partly through the overflow opening *f* and partly through the overflow openings provided in the combining tube *g g'* through the overflow chamber *J* and passage *E E*, and produces a strong vacuum in the water chamber *I*, which lifts the water from the source of supply, and the united jet of steam and water is, by reason of its velocity, discharged into the rear of receiving end of the combining tube *g*. The further movement of the lever *F* withdraws the spindle *h* until the steam plug *i* is out of the forcing nozzle *K*, allowing the steam to pass through the forcing nozzle *K* and come in contact with the annular jet of water which is flowing into the combining tube around the nozzle *K*.



This jet of water has already considerable velocity, and the forcing steam jet imparts to it the necessary increment of velocity to enable it to enter the boiler through the delivery tube *j* and boiler check *k*. If now from any cause the jet should be broken—say from a failure in the water supply—the steam issuing from the forcing nozzle *K* into the combining tube *g* will escape through the overflows *m* and *n* and intermediate openings with such freedom that the steam which returns through the annular space formed between the nozzle *K* and combining tube *g* and escapes into the overflow chamber through the opening *f*, will not have sufficient volume or force to interfere with the free discharge of the steam issuing from the annular lifting steam nozzle and escaping through the same overflow *f*, and hence the lifting steam jet will always tend to produce a vacuum in the water chamber *I*, which will again lift the water when the supply is renewed, and the combined annular jet of steam and water will be forced into the combining tube *g* against the feeble current of steam returning, when the jet will again be formed and will enter the boiler as before.

Changing Rules.

From all over the country, reports of roads changing rules, together with the regular crop of accidents, that comes with all such changes, continue to be heard from. Changing running rules is almost as bad as changing engineers. Those roads that adopt good rules and raise good engineers, and hang on to both, are the safest and best.

Exhaust Nozzles.

There is probably more "monkeying," as it is called by engineers with exhaust nozzles—and as much excuse for it—than anything else. Steam is absolutely necessary to pull cars, and when other means have been experimented with a little, with no satisfactory results, it is perfectly natural for a man to try a little strangulation. There are no engineers in this country, that we have ever heard of, who do not know that an engine will work better and do more work with a large nozzle than a small one. But nozzles will not pull cars, no matter how huge; some steam is also necessary.

Round nozzles, single or double, especially if provided with removable tips, present too good a chance to be turned out or bushed, according to the notion or ideas of the engineer or roundhouse foreman.

Some roads use square nozzles that won't turn out, and are more of a job to bush; but if they are too large for steam making, it is little satisfaction to runners.

A nozzle that can be varied from the cab would seem to cover all the desirable features, and would doubtless be of service to most engineers on the road. There are few engineers who would not gladly shove a small lever ahead, and run with a large nozzle when the train, fuel, fireman and other circumstances could keep, or allow to be kept, steam enough; and it would be some satisfaction to know that he could make the draft cut the fire right by the same means.

A very simple nozzle of this kind is the old one with a taper plug in the center, that can be raised or lowered as desired; it does not cost as much as the ordinary double stand, and has a wide range.

On the Right Track.

The Locomotive Firemen of Chicago have organized a mechanical club, and publish as their aim "To bring together the locomotive enginemen of Chicago for the purpose of discussing all matters relating to the management, care and construction of the locomotive." That there will be good results from this club, and all others like it, there can be no doubt.

Manufacturers of all devices used on locomotives cannot do better than to furnish such clubs with working models of their devices; the results are bound to be fruitful. Many a good device has been condemned on roads just because the men did not understand its working, or the principle that it worked on. Many men, especially after they get to running, avoid this kind of discussion, for fear they will expose their ignorance. This is all foolishness. A few hours per week in this kind of self-taught school gives a man lots of problems to think out, and, if he thinks, asks questions, and tries to post himself, it can but benefit himself, the company for which he works, and the public that he serves.

Success to the mechanical club, its officers, and its aim.

Keep Up.

A railroad company who have built their own cars for a good many years recently gave a big order to a car manufactory, and, as they wanted standard cars they sent their patterns to the works. In a short time the master car builder of the road got back the pattern of a very important casting, and a note saying that the pattern was *more than a year behind the times*—a moulder being able to get out but sixteen of the castings in a day, while with a pattern made on a new principle it was possible to make thirty-eight of the castings. Keep posted.

Special Chuck for Turning Locomotive Packing Rings.

BY WM. H. HUBBARD.

Invitation to air some of our shop kinks in your valued paper duly received; and, while I am not troubled with an over-supply of modesty, I do dislike to hear men shout "that's old." Still, I am satisfied that where these repair shop rigs are old to one they are new to hundreds of

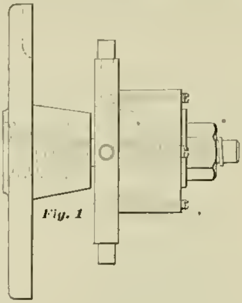


Fig. 1

others, and as you name especially one "makeshift" of ours, viz, a mandrel for facing parallel the "bull" rings and spring rings of locomotive pistons, I send you a sketch of same, but am not the originator of the principle, unless it may be in the combination and materials used in the construction; for it is made of old piston spider heads and follower plates—no new castings being necessary.

The range of work being limited to just what it is made for, it may not seem of great value; but in this respect it is like the pistol in Texas, and it does the work nicely—which is the proof of value in all shop kinks.

The work done on this mandrel must be bored in a common chuck. In making

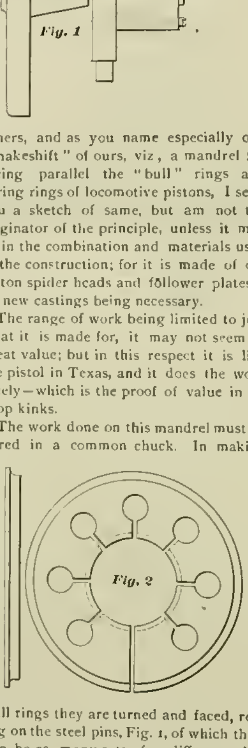


Fig. 2

bull rings they are turned and faced, resting on the steel pins, Fig. 1, of which there can be as many sets, for different sizes of cylinders, as may be required.

In facing spring rings we use expansion plates, made as shown in Fig. 2. These are bored to fit the cone of the mandrel near the face plate, and are brought up square by the follower and nut. The amount of expansion we find to be not over one-eighth inch, but as we make our rings standard sizes, we do not need a large number of plates.

While a common chuck is theoretically true, a machinst who has run a "packing lathe" knows it is impossible to chuck such work true, as the tendency is to spring the work out and away at the jaws. On this mandrel the strain in tightening is towards the plate in all cases.

The thread on the stud is ½ V, leaving the top flat, so as not to wear loose in the follower, which should fit well to hold everything central.

We make a slot in the face plate to admit of a caliper or templet for gauging the spring rings.

As the expansion plates are made of old follower plates, any shop can afford one for each sized cylinder in service.

The Pittsburgh Locomotive Works.

Superintendent Wightman, of the Pittsburgh Locomotive Works, has one of the most complete systems of measurements that we have seen. No mechanic in the works is allowed to use a scale or caliper of his own; there are complete sets of templets, guages and distance pieces for all work. The tool-room is provided with full sets of Whitworth guages and all fine measuring tools; from these the distance pieces, plugs and rings are made. No piece of work is made to fit another piece but a standard measurement piece. For instance, if a man has to make a taper fit of a piston rod in a crosshead, he goes to tool-room and gets a ring, ground to the right size and taper, and makes his rod fit that; the man who finishes the taper hole in the crosshead draws a taper plug and makes the hole fit that. It is an admirable system of manufacture, well worked out, and is shown in the work of this concern. Fifteen years ago Pittsburgh locomotives had a very hard reputation, owing to bad design, but under the management of the present superintendent they have come up, and now compare favorably with any engines built in America. There is not an old-fashioned machine in the works; everything is new, and the latest improved methods of doing work and handling material are in use. The foundry is exceptionally well arranged.

A Tool Breaker.

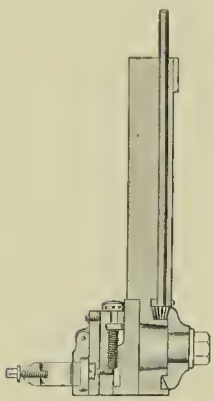
That expensive tools, like taps and reamers, are not broken by unknown causes entirely, was proven to us recently by seeing a cow-puncher using a reamer on a locomotive frame. He was turning the tool with a solid-ended wrench and every half turn he would pull the wrench off and hit the top of the reamer a sharp rap, spit over his shoulder and turn again. The tool was often forced into the work so tight he could not turn it, and the head of the wrench looked as if it had been to a dog fight and got licked. This artist might do to chip rough castings, but putting him to using tools reminds one of the fairy story of the crazy bull in an egg-shell foundry. There is one tool that this kind of a man should always use, and no other—a shovel.

Planer Tool for Locomotive Driving Boxes.

This invention, built by Pedrick & Ayer, of Philadelphia, Pa., is applied to an ordinary planing machine having a longitudinally moving bed and a vertical adjustable crosshead.

The tool is made of a forged bar, heavy and strong, to withstand the strain to which it is subjected. At the lower end of the bar is a circular enlargement, and at the rear of the bar is a groove and a shaft or spindle, upon which is mounted a gear. At the front of the bar is a face plate or head, with a vertical guide for tool carrier. The carrier is made with a vertical adjustment by means of a screw and nut. The gear, fastened to face plate or head, is driven by the gear pinion upon end of rear shaft, which rests within the groove at rear of the bar which gives the rotation of face plate and tool holder, and can be driven by hand or feed gear wheels.

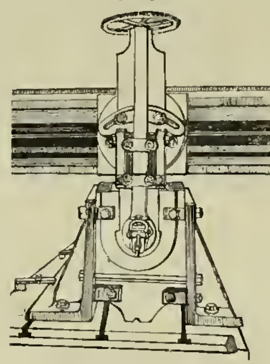
Supposing it is desired to plane out a number of driving boxes; they should be suitably placed in line and fastened be-



tween angle irons to planer bed. The bar or tool is then placed in planer tool post and properly secured and adjusted. The planer is then set in motion, and, at every stroke, a suitable partial revolution to the shaft may be given and a corresponding movement will be given to the tool which moves around the center formed by the spindle, and the entire circular part of the driving boxes, by repeated movements of the planer bed or table, will be planed out. Should the operator prefer, both shoulders of the driving boxes may be squared up before the circular part is begun.

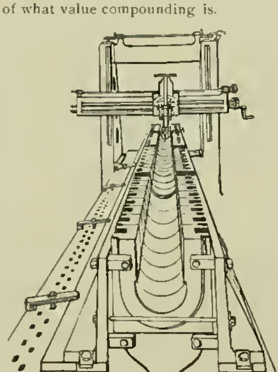
The number of boxes operated upon at one time is limited only by the length of the planer table, and the work will be done with greater accuracy, which will make the boxes interchangeable. This tool is not confined solely to the planing of driving boxes, but can be and is used for performing any similar work Tests prove that it is a big improvement over slotters for this work.

This tool is in use on the Chicago, Burlington and Quincy Railroad Company, giving most excellent results. At their Aurora shops they have a 25-foot planer, upon which is placed 32 driving boxes at one time. The planing for the cellars and shell bearing is finished complete in 36 hours, at the rate of 24 cents per hour—making the cost of all planing 27 cents per box.



Compound Locomotives.

Great interest has been shown of late years, especially in Europe, in the compounding of locomotives—expanding the steam twice. This is advantageous only in high pressures, and as the average locomotive's boiler has made a jump from 120 to 160 or 175 pounds' pressure in the last few years, it is plain, therefore, that there would be an economy in two expansions of the steam. Mr. Webb, an English master mechanic, has built a large number of compound locomotives, and is now building one for the Pennsylvania Railway that will be subjected to a comparative test with some of the best standard American locomotives, with a view to determining of what value compounding is.



Mr. Webb's locomotives have a pair of high pressure cylinders located where cylinders ordinarily are, and having their connecting rods coupled to the back pair of wheels. Between these high pressure cylinders is located a very large low pressure cylinder, whose connecting rod is coupled to a crank in the center of the forward axle. The engines are, therefore, independent of each other, there being no side rods.

It would look to a road man as if this was a complication of parts that could be avoided.

There have been one or two experiments in this country where the high pressure cylinder was on one side and the low pressure cylinder on the other.

We should think that placing a low pressure cylinder at the end of the ordinary locomotive cylinder, and extending the piston rod through to carry its piston—as is done on many ocean-going vessels—would be at once the easiest and best way of accomplishing the desired results. Whether the saving made by compounding will pay for the increased cost to build and repair the engines remains to be determined by experiment and the trials soon to be made on the Pennsylvania will go a long way in this direction.

There is no great mechanical difficulty in the way of compounding locomotives if it can be proven that it will pay.

Clark's Valve Gear.

David Clark, M. M. of the Lehigh Valley R'y. at Hazelton, Pa., has invented a new valve motion for locomotives. It consists of a second valve, riding on top of the regular valve, that cuts off the steam. This valve is controlled from the cab by a second reverse lever. When this is thrown out of gear the engine works as an ordinary plain slide valve engine. The gear is driven by a separate eccentric for each side. If there is anything in indicator diagrams, the motion will do more work with a given amount of steam, and therefore save fuel. Complication is not objectionable when it accomplishes results; whether this gear will save fuel enough to pay for its increased cost and maintenance remains to be proven by long tests in actual service. If Mr. Clark's gear is not better than the link, there is little use of attempting to improve that well-known gear—taking the theoretically correct indicator diagram as the ideal to be reached.

Interchangeable Locomotives.

Building machinery to gauges and templets, so that their parts are interchangeable, has its advantages and is desirable, but it does not go far enough. There is no doubt that it cheapens the cost of manufacture, and is, therefore, a good thing for the builder. After a locomotive has been rebuilt or overhauled at the shop on its home road, the interchangeability disappears as slate pencil marks disappear under a wet sponge. If the shops had a full set of the builder's templets, it might be kept sight of—but a full set of these gauges would cost as much as the motive power on some roads.

We do not believe in standardizing everything. We do believe in standardizing many things. Car, tender and engine trucks can easily be kept to a standard, and always be interchangeable. Pistons, piston packing, valves, links, eccentrics or straps, rod brasses, crossheads, driving boxes, etc., cannot be easily or cheaply kept to a standard, or entirely interchangeable.

Standard shapes and sizes for everything prevents multiplication of parts in repairs.

Established standards prevent the inventive genius of men from trying to improve the power of any road.

There is a happy medium in all such things, and we believe that is the field to occupy.

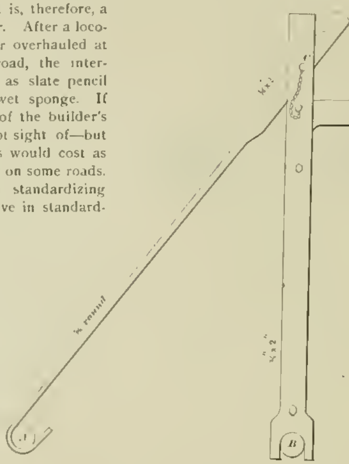
Interchangeable standard men see all the advantages of their system, and are liable to overlook the advantages of others. Men who have bought or run locomotives built to standards and guaranteed interchangeable, have become disgusted with the system when they tried to use a link or a rod strap of one engine on another, and found that they "wouldn't gibe."

If we were buying locomotives, we should buy those built to gauge; when repairing them, we should try to preserve some of the sizes and let the rest go.

Engines are not worn out alike, and after a year's service many of the best made parts would not work well on other engines.

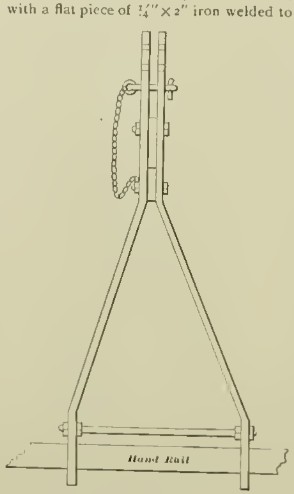
Engineers, Beware!

The New York *Post* is the father of, and deserves all the credit for, the new order of things that will dawn on the country within six months. It proposes to teach locomotive running in the public schools. Everybody will be engineers. People have had an idea for years that locomotive running was a trade learned only by several years of close application and hard experience as firemen, but the *Post's* easy way out of the strike trouble knocks an old and time-tried custom in the head. It is so simple that it is a wonder that some other 22-caliber idiot never thought of it before. First class in locomotive engineering, stand up! Jimmie *Post*, this is not your class, a boy has to have *some* sense to learn engineering. You belong in the primary class of wipers.



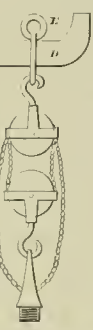
Portable Hoist for Air Pumps.

The advantage of this hoist consists in its being easily and quickly adjusted to almost any engine. It is attached to the hand rails, as shown at *A* and *B*. The tension rod is made of ⅝" round iron, with a flat piece of ¼" × 2" iron welded to



its upper end, with several holes in it, so that, by inserting the pin *C* in the proper one, the bar *D* may be brought to a horizontal position. The pin is attached by a small chain to one of the bolts in upright piece, so that it will not get lost. A short hook to attach to whistle stem may be used where the dome comes immediately in front of pump brackets. A sheave, *E*, runs on bar *D*, and to it a differential pulley block is attached, which hooks into an eye plug having a thread cut on its lower end, to screw into top cylinder head of air pump, in place of reversing valve cap, which may be temporarily taken out for this purpose.

With this arrangement one man can easily take off or put on a pump in a short time. By using the chain pulleys, the pump may be drawn up and left suspended, and the man can have both hands free to move the pump in or out and adjust the bolts in their holes. Any shop that has one lathe and a blacksmith shop can make one very cheaply.



Hiram R. Jones.

A Lost Art.

On a recent visit to the home of an old time engineer we saw on top of his book-case a pair of large brass eagles, and wondered at their being there. The old-timer leaned back in his chair, and said: "Your hair is hardly gray enough for your experience to date back to the time an engineer used to have one engine for years. I used to run a pet engine, and those brass eagles rode beside her headlight for thousands of miles. She was a brass angel, anyway, and I'll bet there has been two years of solid work, and $200 worth of cleaning compounds wasted on those eagles by the many firemen who have groomed the old girl. I had more brass than a little; fine pair of flag staffs (they are out in the wood-shed now), and a dozen brass traps for the cab. One day my pet came out of the back shop a "Black Maria," and I rescued those eagles and some more gew-gaws from the brass foundry. It was but a few years more and I was running an express engine on the 'chain gang,' 'first in first out,' 'catch as catch can.' Brass statuary for locomotives is one of the lost arts."

Looking Over Your Shoulder Without Turning Your Head.

Many engineers, on roads where long trains are hauled, have a small mirror hinged to outside of cab, in front of and above the engineer's face; a sliding rod and set screw allows the glass to be set at any angle, or folded up entirely. When set out at right angles to the cab it shows the rear of train, night or day. By a glance at it, on a curve or other favorable piece of track, the runner can see if the train has parted, if signals are being given, or if anything is wrong with the train without turning around to look back.

The B. & O. have many locomotives, especially heavy freight engines, that have a ¾-inch relief cock in the steam chest connected to cylinder cock rigging.

Special Locomotives.

We recently paid a visit to the locomotive works of H. K. Porter & Co., Pittsburgh, Pa., and found their large shops very busy on light locomotives for various grades of service. This company make light locomotives, of all gauges, and with cylinders from 5 x 8 up to 14 x 24. They had in the shops some street-car motors for California, several wood-burners for lumber roads in the South, a Forney for suburban traffic, one little engine of 20-inch gauge for a Lake Superior copper company, and a number of odd sizes ranging in gauge from 36 to 42 inches. These works have developed the light locomotive business in the United States more than any other makers, as they have made a specialty of this branch of manufacture.

Their engines are made to standard sizes, and a large stock of "extras" are kept on hand to send out to owners. They have a large trade in driving boxes, links, eccentrics, springs, tires, etc.

The engines are put together with a view to their easy repair by men in charge of them and away from shops. Tire on drivers are put on on a taper and held by bolts; these can be removed and the tire taken off with a sledge cold; all parts liable to wear have means for taking it up, and in case of pins there are always bushings put in when new, that are easily replaced.

We believe this is the first firm making locomotives that have introduced the profit sharing principle into their works. Two years ago, Mr. Porter started on a small scale to get some data to work from, and last year set aside a certain per cent. of his profits to divide among his men. This was apportioned to each man in proportion to the amount of wages he had earned in the year.

Last year the amount each man received was about ten per cent. of his wages. Foremen got from $300 to $125, machinists from $120 to $70 and laborers from $60 to $45. This is an inducement for the men to put in as much time as possible and to work as honestly and avoid errors and mistakes as much as if they were working for themselves. General Foreman Frank Lackner says he finds a big difference in the men and their work since the new order of things. Every man who earns a dollar for the company during the year is entitled to his share of the profits, and the company have in their safe, checks made out for many different men who worked for the firm sometime during the year. After the distribution of profits this year, the employes of the works presented Mr. Porter with a very flattering testimonial of their esteem, and passed resolutions showing what they thought of the system. One of the items we noticed was that, in the estimation of the men, it was a cure for strikes, as they could ill afford to strike against a business that paid them good wages and in which they had a dividend-paying interest.

During the year the works had 440 men on the pay roll, the regular working force being about 265.

New Steam Heater Coupling.

We illustrate herewith a new steam hose coupling, the invention of James B. Clancy, of Springfield, Mass. Most hose couplings use two pieces of hose between the cars, a coupler head on each; in this coupler but one piece of hose is used. On each end of this hose there is a coupling piece, like Fig. 3; this has taper lugs on each side, to enter the slots in the union nut, with a handle, shown in Fig. 4. The end of the hose piece has an octagon opening that fits over a projection on the

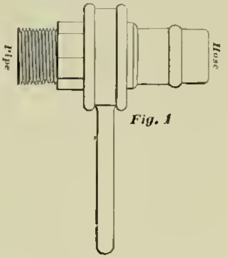


Fig. 1

pipe end of coupler. This serves to prevent the two pieces from turning from each other when the clamp nut forces them together, and also to carry the steam past the joint for about an inch. Any kind of gasket can be used between the

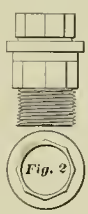


Fig. 2

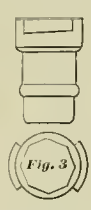


Fig. 3

butt joints. A coupling before us has a thin copper one, that has been doing service for five weeks on the Connecticut Valley Railway. By using but one piece of hose, two clamped hose joints are gotten rid of. Extra pieces of hose are cheap, and can be carried, and if a joint should

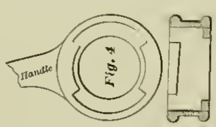


Fig. 4

leak, a change of gaskets is but the work of a moment. A quarter turn of the handle locks or unlocks the clamp. The coupling has been tested for some time, and as yet has shown no weak points. Its simplicity, and provisions for keeping a tight joint, should make it a lively rival for more elaborate devices.

At the Pittsburgh Locomotive Works we noticed several engines going out with Krupp tire not turned off on outside. It is unusual for tires to be put on and be true on outside.

A Rod Key Kink.

The key in front end of main rod on most locomotives, especially those not having the four bar guides, is generally a source of annoyance to engineers. The first single beam guides had a slot through them, and also the crosshead and gibs, to allow a bar to be placed through them to drive down the key. This weakened the guide, crosshead and gibs, and was hard to get at, as the engine must be placed in a certain position to make the slots "gibe." The next move was to put the key in from the bottom and drive it up, if the set screw worked loose—and it will if the crosshead needs lining up badly—the key was lost, tne brasses might have enough play to let the shock shear off the strap bolt or knock out a cylinder head, or both. Then they made a solid front end to rod and tightened the brass by a taper key *drawn* in from the back side by having a thread and nut on the outside. This permitted the use of a large key, but it took two men to keep them properly set up; they *would* work loose. The Pittsburgh Locomotive Works are making a solid front end on rod, the brass being tightened by a large key driven in from the outside and held in by a set screw on top of rod. The upper side of key has a slot as wide as a set screw, and about 1/4 inch deep, and running to within 1/2 inch of each end of key. On the bottom of this slot the set screw grips; if the key works loose it can only get out to end of slot, and the pound will notify the engineer by telephone. It is a simple kink, and as good a one as we ever saw. Why not slot the side of all rod keys? There would be fewer keys thrown at people along the route.

Compulsory Labor.

One would think, to read some of the daily papers, that the Government of the United States was a despotic monarchy, and that the said newspapers were the reprint of royal decrees. One of them tells how a little "judicial thunder" from some petty judge out West scared a lot of U. P. engineers from thinking of striking to help the Burlington men. According to them, there is, and should be, a law to prevent a man from stopping work if he wanted to. Such stuff is nonsense, pure and simple; such utterances are calculated to do a world of harm in widening the breach—already too wide—between labor and capital.

We heartily commend to the thoughtful consideration of every locomotive engineer and fireman in America, the noble and honorable sentiments expressed in an article headed "Hiring Engineers," in the March number of the *Locomotive Fireman's Magazine.*

Arrangements have been made with the American News Company and its wholesale branches by which copies of THE LOCOMOTIVE ENGINEER will be regularly supplied to and kept on sale by retail newsdealers in all parts of the United States and Canada.

A Valuable Tool.

Pedrick & Ayer, of Philadelphia, manufacture tools especially for railroad repair shops, and, knowing the want of a tool to plane up and finish driving boxes, truing brass as well as the box itself, they got up designs and patterns for a heavy tool for this purpose, built on the shaper plan. The tool did nice work, and the firm had great hopes of it, but about this time their attention was called to the planer attachment for the same work, shown in this issue, invented and patented by C. F. Geyer, general foreman of the C., B. and Q. shops, at Aurora, Ill. They saw the utility of the invention, and at once made arrangements to manufacture it. It could do work faster and cheaper than the regular tool, and could be sold for about $150. The special machine just got out was abandoned and the patterns laid on the shelf. It sold for $2,000, and the firm knew very well that no shop would pay that for a machine when they could get a better one for less than $200. Shop kinks are often valuable—have you got one?

A Hand Blow Back.

Our valued correspondent, J. J. Bingley, gives his idea of a fuel saving device in a valve and connection to send surplus heat to the tank. This is doubtless a very good idea—much better than the scheme that attached the pipe directly to the safety valve and obliged the extra steam to go to the tank always. There are times—lots of them—where, on account of low water in tank, or heat stored up there till the pumps or injectors would not work, it is very desirable to let an engine "blow." Mr. Bingley's idea appears to be the happy medium that we all want to reach.

The B. & O. have condemned all the old camel-backs that will require an expenditure of $1,700 for repairs.

Correspondence

A Lesson on Valve Motion.

When I was a "cub" around the shop we had lots of old locomotives, hook motions as well as links, and I got pretty handy at doctoring valves that were "out." A few years ago my engine was in the shop, and I worked for a couple of months in the roundhouse. One day an engine was ready to go out that had just got a half rebuild in the roundhouse; the foreman asked me to set her valves. I did so, proceeding in the usual way; got her dead centers, made her port marks on valve stems, by using tin in ports and a good steel tram, divided the travel very carefully, and pronounced her O. K.—but she was not. Her engineer took her out into the yard and she started off, holding up one leg, as if some one had stepped on her corns. He brought her back and I went over every point again, but could find nothing wrong.

They got the pet valve man out of the back shop; he was an English machinist, and had his nose at an angle of 45 degrees at the very idea of letting a "driver" set valves. He explained to me that an engine at work had a big load on her valve, and he had a couple of coil springs that he rigged up each side of the rocker box to keep up all slack, and after it all did not change a bolt I had set—and still she limped.

They examined her nozzles, her valves and valve seats, and all were as they should be. All hands were stuck. The division master mechanic sent out in the yard for an old engineer running a switch engine. He had lost a foot in some former wreck on the rail. He hobbled into the roundhouse on a cork foot, and the master mechanic said: "Peggy, the cob chopper won't chew her cud square; I wish you would take her out and see what is wrong. Take John along and give him a few pointers." I had fired for old Peg, years before when he had the use of both hoofs. We went out and up a long side track, and Peggy turned to me and said: "Jack, are you sure you have her all right—line and line?" I was sure. I set the tank brake and ran the engine slowly, and Peggy hobbled along beside her, looking for her limp.

We stopped, and the old man came to the gangway and said he guessed he had it cornered, and asked for a half dozen coal checks. I got them and got down. "Now, Jack," said Peggy, "you see, as sure as you live, one of these link motion engines has got to be right, and I believe this engine's valves are square as a die; she ain't lame at all; she's *lopsided*. Get a monkey wrench." I got one. "Now, Jack, you stand down here and squint across the top of them arms to the tumbling shaft; looks like they was straight, and yet it don't; may be they are, may be they ain't; but we'll get this here scrap square, all the same, by the tumbling shaft. You see, if one of them arms got bent a little in kicking around the shop or being put up, or if one of the pins was wore more than the rest, or one of the hangers was a trifle too long, or one of the rocker boxes were a leetle high or low, it would make it impossible to find where she was out by the trams; it would be jest the same as if she had two reverse levers and one of them was working a notch harder than the other. Now, you loosen up this tumbling shaft box on this side, and we'll block her up a trifle with card board and see how she acts."

We did so and she was better; we gave her a couple more tickets and she was square. The old man trimmed off the card board outside the box and smeared the edge over with black grease. We went down in the yard and got hold of a string of cars and pulled by the shop with every exhaust just exactly like its twin brother from the other side. To the valve expert's questions the old man replied, "You fellers got her stack on wrong side before," winking at me. To the master mechanic he said, "I guess the boys made a little mistake in making that new rocker arm or box or in setting it, or perhaps the arms of the tumbling shafts are bent. It would be better to go over those points and correct the real fault, and take that gun wadding out from under the box of tumbling shaft; still she is old, and it won't hurt her to run that way. Next time you have a bad case of limp send for John here; I have been giving him a few lessons in the artificial leg business."

And, giving me a sly punch under the arm, he hobbled out into the yard and read a paper in the soothing shade of the water tank, keeping his weather eye on the motions of his fireman, who weighed coal cars and played engineer.

JOHN ALEXANDER.

Encouraging Master Mechanics.

The master mechanics are a valuable set of men in their own estimation or while in convention, but fall very short of convincing large railroad corporations of the fact.

A well qualified master mechanic gets a good salary, say from $150 to $250 per month, while his engineers make from $180 to $190 per month.

Now the M. M. gets his $150 or $250 per month providing he has some good friend to put him in position.

Remember, they are all paid by the month, so they can be fired out at any time the management may wish to do so; while cooks, waiters, etc., are paid by the year.

I am only surprised that, while a master mechanic is of so little use, that they are employed and paid such enormous salaries, when they could be so easily done away with. I am sure the traveling public could do away with them better than they could with cooks.

I am sure any of your $10,000 cooks could keep the world in motion without being bothered with the high-priced mechanics. If a man is a good judge of beefsteak why should he not be a good judge of iron and steel and of engineers and firemen?

I wonder if those $10,000 cooks get annual passes over the different American railroads. I am sure master mechanics do not. I can answer for that myself, being one of the unfortunate M. M's, and ex-member of the Master Mechanics' Association, caused by being refused passes from Philadelphia to Boston. My thirty-three years' experience does not count in machinery department of railroads, therefore I am not entitled to passes, and this after spending and devoting my lifetime to railroads. Oh, why did I not learn to be a cook, and keep out of conventions and mechanical departments of railroads?

I was told by a traveling man three or four days ago in my office, that two very liberal managements in Iowa gave their master mechanics the privilege of attending the last M. M's. convention—providing they would pay their own expenses and lose their time while gone.

This is generosity and kindness personified on the part of the management toward men who meet in convention solely to discuss methods to do their work cheaper and better—profiting by each other's

experience. How long will this continue so? E. A. Campbell, M. M.
Houston, Texas.

Babbitt.

I have had considerable experience with babbitt metal, and the conclusion I have come to I sum up in the following lines: I have known two identical cases on different roads and different build of engines, one a Schenectady, the other a Baldwin, where the main pins ran warm enough to cause considerable anxiety to engineers for several weeks, and in each case the remedy has proved effectual, which was to remove babbitt and substitute leather.

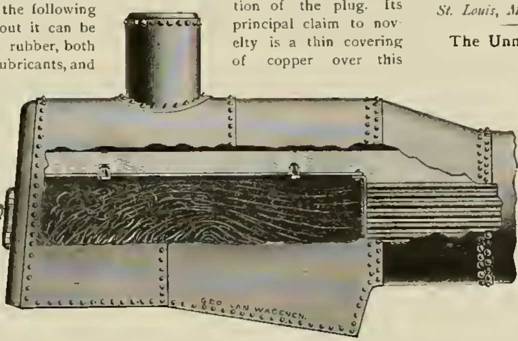
I believe that babbitt in any case is unadvisable on back-end bearings of main rod brasses, even when put in near top and bottom of brass, a strip dovetailed, say of ¾-inch wide; and when put in the way just stated, is the best for the following reason: In case of melting out it can be replaced by leather or sheet rubber, both of them good absorbents of lubricants, and they can be re-babbitted easier than other ways; the most objectionable way is to drill holes all over brass, including crown, for the reception of babbitt; in this case, when brass has been hot enough to melt it, there is no other way but to re-babbitt, which takes time, or to do as I did once with a brass, which had bothered us a great deal, on a ten-wheeler main pin—drill holes deeper in crown of brass, tap them and put in brass plugs, then slot brasses as aforesaid, and put in leather; the reason for filling up the crown with plugs was the want of bearing in the right place; we were never troubled with that brass after. But if babbitt is objectionable in rod brasses, it is much more so in driving box brasses, when they become hot enough to melt the babbitt, which they do sometimes (every mechanic who has had to remove it from driving box while engine was in round-house, and, as is generally the case, engine wanted as quick as possible, will agree with this), they fill up oil holes, and the metal, which was put in to save the brass and make it last longer, is the cause, in that case, of wearing it in one trip more than one year's ordinary wear would do.

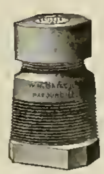
It is of course understood that the rod brass, from the same cause, has the same effect, only in this case it can be got at easier, and in consequence, as a rule, less profanity ensues. This has been my experience with babbitt in the negative; in the affirmative, I have found babbitt very useful in conjunction with copper plugs for taking up lost motion laterally, on crossheads and driving boxes, next to hubs of wheels; have also applied it with success on tops of crossheads, where it does good work, and is not as expensive as other metals to apply, taking labor into account; have also used it to advantage, taking up lateral motion, on rod brasses, by drilling holes around brass and driving in every alternative hole copper plugs, leaving them as much longer as required, to form a dovetailed head by riveting with hammer; this not only helps to hold babbitt in place, but makes it wear longer and gives good satisfaction.
Missoula, Mont. Jos. Wormalo.

The Bailey Soft Plug.

We show herewith a new style of soft plug, the invention of W. H. Bailey, an English engineer, and being introduced in this country by Geo. Van Wagenen, of 233 West street, this city.

As will be seen by the perspective view, the top of plug has a removable nut that holds the cap of fusible metal in place. The section shows the general construction of the plug. Its principal claim to novelty is a thin covering of copper over this fusible gasket. It is claimed that the action of the water changes the character of fusible metal, making it impossible to melt it at the proper heat. The inventor of the new plug has aimed to avoid this trouble in the copper cover. The action of the soft plug in protecting the crown sheets in cases of low water is perfectly familiar to all engineers, who can readily see the advantages of this particular plug.





The large cut shows two plugs as applied to very long fire boxes.

Points on Air Pump Repairs.

When air pumps are repaired in the roundhouse they often get mixed up in their bearings and act queer on the road.

The other day my pump was overhauled, and I was called out in the night to go to a wreck, in a hurry. The engine was in the yard and hold of the wrecking car, and as soon as I arrived I filled lubricator and started air pump and got down to oil. In a few minutes the pump began to labor hard, and slow down, and finally stopped. I thought the exhaust was stopped, and disconnected the exhaust pipe, but the pump stood still; I got up in cab and the gauge showed 80 pounds of air. I tried the cock on air drum, and there was no pressure there; then I started to take engine to roundhouse, and found the tank brake was set. I investigated a little further, and found that the machinist had connected the reservoir hose to the train pipe, and the train pipe hose to the reservoir, between the engine and tank. The pump could only fill the length of pipe on tank and the brake cylinder. I traded hose connections, and all was well. We use straight air. I find it good practice, if a pump works hard, to investigate exhaust pipe; they often stop up, and for pounding I find the air valves are the cause of most of it.
St. Louis, Mo. John Veroer.

The Unnecessary Half-Notch.

In your March number you had a little item on the half-notch that shows how inferior the American locomotive is to our British built machines. We use a screw and hand-wheel to suspend our links, and it gives us a chance to cut off at any point we choose, even to splitting your *half-notch* into eighths. English.
Jersey City.

[The remarks of our correspondent as above are very amusing, if nothing else. The British locomotive, with its screw reverse gear, may *split* hairs or anything else in point of cut-off, but how long does it take to get one from full gear forward to full gear back, when in a hurry to avoid an accident? One English built locomotive that we are familiar with, came to this country to surprise the natives—and it did. It took ten revolutions of the wheel to get it from full forward gear to full back, and was continually getting through the roundhouse or off switches on this account, although run by an imported engineer from across the salt-lick, who was used to the "critter."]

Stopping Locomotives.—A Question for Roundhouse Men.

The boys are much pleased with the paper—it is just what they want. Some pointers, a little logic, and no algebra. There is always something to learn about a locomotive, and no man knows it all; but lots of engineers are too proud to acknowledge this, yet it is often proven to them in little mishaps on the road.

I see by the first number that you have a few practical railroad men for railroad commissioners in the States. I wish we had some in Canada, as in many cases here our companies have to pay big damages because there are no practical men to question the assertion of witnesses and jurymen who may never have been on a train, and seem to think that a locomotive can be stopped in a few yards at the outside. I have had farmers race with me for a crossing, and if by chance they got across before the engine did they turn around and laugh at us; but if it happened the other way and horses were killed or a wagon shivered, they immediately sued the company, and *prove* that the engineer should have stopped. I have been running on the Grand Trunk for the past fifteen or sixteen years, and have had many different firemen in my time, and have watched them closely. The ones that require to be told to do everything every time you want it done, that never think of picking up a broom unless told to, who clean their lamps, fill the oil cans or do any other of their duties only when asked, whose oil, clothes and tool boxes are half full of cinders and coal, and their engine always dirty, who work only to get in their trips on the engine and keep their pay up, are the men who make our incompetent, careless and ignorant engineers.

On the other hand, the boys who seemed to take a natural pride in keeping things neat and handy, and, by taking advantage of time in delays, have kept things in such shape that they made it very pleasant for the engineer, and easier for themselves—they are the men who are our best engineers. John Alexander was right when he said good firemen make good engineers.

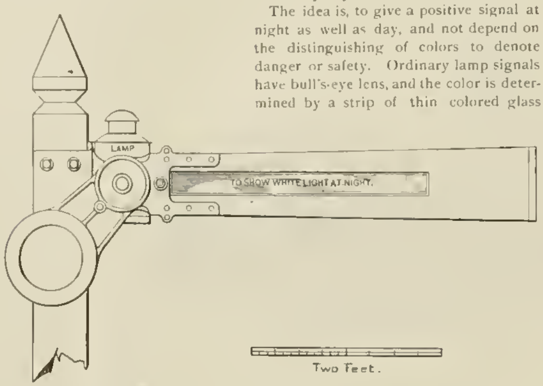
I hope the question and answer column will be freely patronized by the boys. There are a number of items I should like to see shown up myself. One I will ask now: What good does it do to book repairs when the boss fitter will cross it off and tell you he will "keep his eye on it"?

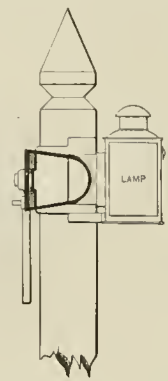
Montreal, Canada. JOHN ALLAN.

Illuminated Semaphore Signal.

The engravings represent a new illuminated Semaphore Signal, as manufactured by the Union Switch and Signal Company, of Swissvale, Pittsburgh, Pa. The larger cut is a front view of the signal, in place on the post. The strip in the blade is fitted with glass, through which the light from the lamp is reflected by means of suitable reflectors, shown below. In this signal the only duty of the lamp is to render the blade visible at night, and the slot in the blade is so proportioned that it presents a broad band of white light at night, of the same general form as the blade by day, making a positive signal at night as well as by day, no colors being used.

The idea is, to give a positive signal at night as well as day, and not depend on the distinguishing of colors to denote danger or safety. Ordinary lamp signals have bull's-eye lens, and the color is determined by a strip of thin colored glass





slipped in behind this lens; should a red glass break, and they often do, the lamp shows white, or safety, where it should show danger This signal avoids the use of colors, and is safe with color-blind men.

Air Pump Conundrum.

I want to see air pump and brake discussions in THE LOCOMOTIVE ENGINEER, and, to start the ball rolling, will give a little of my own experience.

Some time ago an engine came in with her air pump working badly; the piston would move upward very slow and would go down very fast; the first thing I did was to examine the top discharge valve seat, thinking perhaps it had worked loose, so as to prevent the valve from lifting; but the trouble was not there. I then took off the top cylinder head, but found nothing there. I then put the head on again and started the pump, and when the piston was on the upward stroke I shut off the steam, took off the reversing cylinder cap to see if reversing piston had forced the main steam valve down. I found it had; but to be sure that the reversing piston was all right, I put new rings in it; I also put new rings in main steam valve, put everything together again, but the pump acted just the same. I then took off reversing valve cap to see if reversing piston had performed its work, and found it had. I then took off the head for the third time, and found—what?

If any one working at air pump repairs will guess what the trouble was, I will send him a good cigar, care of THE LOCOMOTIVE ENGINEER. W. F. R.

The Richardson balanced valve is being applied to about 75 locomotives per month. Several roads that have had a few in use for a year or two are putting them on all engines that come in.

Some Pointers for Firemen.—A Barometer and a Blow Back.

It is said by someone that the steam from the locomotive is a good barometer; for if the steam remains long in sight, it proves the air is saturated with moisture, and rain may be expected. But if the steam evaporates quickly, it proves the air is dry, and fair weather will follow. But I have often seen steam from locomotives so full of moisture that there was a kind of fog falling all over the train. Indeed, I knew an engineer who was so accustomed to watching the exhaust steam, that he could tell when to put on and shut off the pump, without trying the gauge cocks.

Many engineers would be surprised if they could know the difference in the coal bill, by carrying one gauge too much water, beside the cut valves and cylinders by carrying water too high, as it washes out all cylinder oil.

Some firemen have an idea that to always have the steam blowing off is a sign of a good fireman; it is just the reverse. This is a matter that is being looked into more than formerly; I knew a R. R. President who said it cost five cents every time the whistle was blown. It may not have cost that much, but it shows that these things are noticed.

The heater can be used when standing, to blow the surplus steam back in the tank, and if firemen only knew how much difference it makes to have the feed water heated twenty to fifty degrees, they would watch every chance to put on the heater, instead of blowing it off at the safety valve. This cannot be done so well with the injectors or heaters blowing into the feed pipe, as it injures the hose. I used to put a $\frac{3}{4}$" angle valve for a heater and run a pipe under the footboard, also under the front end of tender, and through the floor and up the side of and into top of tank, and down into the water, connecting the engine and tender pipe with a piece of air brake hose, and a union, allowing slack for oscillation, and whenever the fireman saw the gauge hand was going to the blowing-off point, he would open this heater, and it saved the annoyance of blowing off, and gave him a chance to store up power for a hard pull.

It is the ambition of all good firemen to get to the right side of the footboard; but how few of them try to qualify themselves for advancement; they can do wonders, to hear them talk in the roundhouse; but if the engineer has got some work to do about the engine, and needs a little help, they often grumble about always being at work, and skip off, when they might have learned something there that would have served them well in after years. I heard an engineer once say (who had been running, I think, seven years) that he had never seen the inside of a steam chest. A man with no more ambition than that, could not run for me. He had been one of them sooner fellows —sooner not work. Remember, there is always room at the top, and persistent climbers generally get there.

J. J. Bingley.

An American Railroader Off the Reservation.

I am a Yankee fireman and on a visit to England with my father, who was a former subject of herself, the Queen. This morning I got a paper and it told of an engine recently brought to the repair "shed," that had experienced a peculiar accident. It read: "In striking the tack spline at the west point in Cranshire, the little end of connecting bar unhobbled, knocking off siphons, clacker, trailing splashers, and spring shackles, letting the engine so low that the life guards caught the next spline, and turning the locomotive into a goods train on siding, derailing several wagons; the driver was scalded by escaping steam and the stoker was badly burned in reducing the furnace fire. The break-down van was several hours in clearing the wreck."

I made a pilgrimage to the said shed to see the cripple, and found that the front end of the main rod had come down or broken at the frog of west switch at Cranshire and knocked off the check, wheel cover, oil pipes and spring hangers, letting the big hooks in front—there are no pilots—catch the next frog, ditching engine and crashing into a freight train on side track; the "wagons" are cars, and the "break-down van" the wrecking car. I also heard a "driver" telling the foreman that his "cistern" leaked, and I went to see them look at it—it was the tank. It seems to me this is railroad English, "as she is spoke."

Yank.

London, Eng.

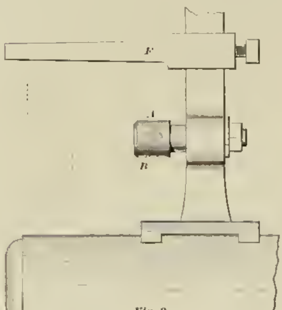


Fig. 2.

Handy Ratchet Drill Frame.

We illustrate herewith a very handy ratchet drill frame, specially designed for boiler work. It is the invention of John Lee, foreman of the Lehigh Valley shops at Hazelton, Pa., and was patented by himself and Master Mechanic Clark some time since.

Shop men are perfectly familiar with the makeshift frames and braces often rigged up to use ratchets.

As will be seen by Fig. 1, the standard of the frame has a slightly curved base plate, about twelve inches square, with a sharp steel point at each corner. Above the plate a few inches is a heavy bolt *A*

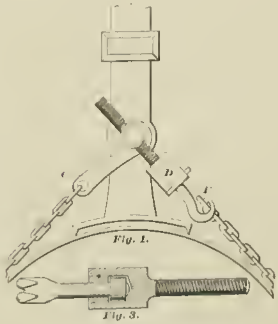


Fig. 1. Fig. 3.

(Fig. 2), that can turn in the standard. This has a threaded hole *B*, through the head, and a recess turned back of head to receive the hook *C* (Fig 1). This hook is attached to a cable chain of the proper weight. The bolt *D* (Fig. 1), has a swivel hook in its head, as shown in Fig. 3.

The brace can be set on the top, side or bottom of boiler, or any other work, the hook *C* attached to bolt *A*, and the chain passed around the work, and the hook *E* grappled to it. A few turns of the bolt *D* draws the chain tight enough to hold the frame firmly where wanted. The brace arm is held by a set screw in any position required. The device takes up little room, and is not in the way of other workmen.

A mechanic who has had to rig up to drill a hole in the side of a locomotive dome can see what a handy rig this would be.

Wedgeless Locomotives.

I am an old fogy. I can't help it. I am only old fogy about some things, however. I believe that many of the earlier ideas, properly worked out, are as good and better than some of the would-be improvements of later days. I like improvements, however. I believe one good injector is worth four pumps. I believe one good sight feed lubricator is worth a dozen tallow cups. I believe solid rod are better than loose straps. I think anything that saves work in repairing engines, or prevents the necessity of repairs, is good. I have rode an engine for many years, and I have been foreman of a shop for many more. There has been considerable said and written in the past few years about "monkeying engineers," etc. Now, I am old fogy enough to take square issue here. The engineers do not intend to "tinker;" they are *too good*, they take too much care of their engines. The men try to keep their machines up, and they will adjust rods exactly right, but they cannot adjust worn driving boxes and brasses, and the wheel cramps and twists about, and the closely adjusted rod comes off the pin. If the rods were solid they would wear loose as the box wore loose, and the engineer would not be blamed if it did pound or rattle.

If I were building locomotives to my own notion I would never have a driving box wedge except on main box. A runner naturally keeps his wedges set up just as snug as he considers safe, and is, therefore, careful to oil them. Let him lay off and a strange man go out on the engine; he forgets or neglects to oil as carefully as the regular man, and the box begins to chatter as it gets dry; as it sticks it gets warm, and by the time it expands a little it is cutting and sticking, turn about. After a box, shoe and wedge are once cut there is no more close adjustment with them. Now I contend that a driving box that has no more lost motion than a thickness of tin is all right; when they would take this much I should put a shim behind the shoe. I think this would prevent stuck wedges, cut wedges and boxes, relieve the engineers of an irksome, yet necessary duty, be cheaper to build, run and maintain, and do just as well or better than the *too good* devices we now have. Locomotives are expected to do rough, heavy work, and I think there is such a thing as making them too nice, and too finely adjusted.

Primer.

The big Strong locomotive has solid wrought-iron driving wheels, made by Krupp at Essen, Germany.

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NEW YORK, APRIL, 1888.

CONTENTS.

The Coal Record Farce.

Every month nearly every road of any consequence in the country posts up in its offices, shops or roundhouses a bulletin showing the expenses of each locomotive in service ; how much coal she burned per mile run, how much oil, tallow, waste and repairs were needed, and many other items of equal interest. As ordinarily kept these records are worse than useless.

The general plan is to require the engineer to give a check for all fuel received, and he does. The coal is piled into chutes, buckets, dump cars, or is shoveled on to the tender, and in every case it is a matter of guesswork just how much is put on to tank. Often an engineer requires a full tank of coal, and the man in charge of coal chute agrees with the enginemen that fifty bushels will fill it, but he has no chutes except 75 or 100 bushel chutes, and rather than go "short," the engineman gives a ticket for it, and receives half of it—the rest runs off, or is shaken off as soon as the engine gets to running.

Again, the engines are coaled up and sent to the roundhouse, where they are robbed to keep up stoves, boiler makers' forges, etc. This is about as fair for one engineer as another, but it is not as fair for the engines.

Guesswork is uncalled for. We are satisfied that good and efficient coal chutes can be devised, where all the coal is received from one chute, in any quantity desired, and while the tender is standing on a pair of scales that weigh the tank *before* coaling and *after;* in this manner the engines will be charged with the amount of coal actually received. Stop the shop robber and let the engineers see what records they can make on a fair basis.

We know positively that many roads must account for every pound of coal *purchased*, and all losses by theft or other causes in transportation, in handling, in amounts used in shops and offices are *averaged* and charged up to the locomotives in service. This is encouraging to the men who try to make a fair mileage record.

The officials of a road who go on the supposition that there is no waste or shrinkage in coal or oil in handling are very impractical railroad men. Charge shrinkage to shrinkage, and give the boys and the engines a show.

We hear lots of "taffy" for English locomotives as being much lighter on fuel than American locomotives. Perhaps they do not have to account for coal lost, stolen and burned in roundhouse stoves.

Graded Pay.

The great strike on the Burlington system has called out a great many so-called editorials—from all classes of writers—on the above subject. The "hustler" who carries the reportorial Faber on the daily press has just outdone himself when he could interview the railway manager who would explain to the world—through the reporter—that if it were not for graded pay the railroads would never promote firemen and take the loss of their first year's blunders ; they would hire competent and experienced engineers always. The manager, or the reporter, forget to mention the place where this great supply of experienced men is coming from. According to them the "woods are full of engineers," experienced, competent, and always out of work.

The idea of the manager is to get the firemen to think that graded pay is their only hope of promotion. The action of the firemen in the Northwest troubles shows conclusively that this class of men are intelligent, posted, and know that the man who manages a railroad in the interest of stock gamblers cares not one iota whether the firemen are ever promoted or not.

If all managers could have four or five grades of pay they would soon have the country full of engineers, as they would take pains to find an excuse to dismiss men as fast as they got to the full pay notch.

With the country full of half-starved engineers, the management could cut wages down to the rate they would like, and once down they would remain down.

If one man runs an engine on freight, and daily goes over the road with fifty cars, getting therefor $3.00, it hardly looks fair that another man should do the same work for $2.00.

On any road where graded pay is in vogue, the company are just as willing to use a cheap man on an important train as a full pay one. If the company is sued for damages in case of trouble from incompetency, the manager is always ready to swear that the third-class pay engineer is a first-class engineer in every particular—but he pays him third-class pay because he is inexperienced. Like Mickey Flynn's whisky, "it will keep you warm in winter and in summer it will freeze you."

The Burlington manager was very particular to cite some isolated cases of light passenger runs on branches and compare them to main line runs, stating that they could not pay men as much for such runs as for the hard ones on the main line, because they did not do as much work. He offers no excuse for three grades of pay for pulling freight over the same division.

As a rule, promoted firemen do not make the mistakes on the road that hired engineers off other roads do ; they know the road. The firemen would rather remain firemen a year or two longer and then become engineers and receive engineers' pay, than be promoted to a great responsibility without pay in proportion, and with a premium on his discharge as soon as he reached full pay.

Pay men on switch engines less per day than men get on the main line—if some form of graded pay must be kept up—but do not pay a man half wages for doing as much work, taking the same responsibility and earning the same money for the company as another man getting first-class pay. We have noticed for years that newly promoted men who made bad breaks on the start were speedily "set back" and made to fire a few years more or else discharged. The officials did not charge up the expense of his developing experience to the fact that they would get his services for from one to three years for less than he was worth. They demand and receive first-class service for third-class pay. Is it right? Is it fair? Should a man who has started a new grocery, as an experiment, be expected to sell sugar, flour and other staple goods at two cents per pound when the ruling price was three cents? If he furnishes the staple, does it make any difference whether he has had a number of years' experience in handling it? Is not labor the king staple of the earth?

Graded pay is not a fatherly endowment for the education of locomotive engineers. It is a reduction of wages, pure and simple, with no other object in view. If any human being on earth is entitled to good pay, without previous servitude, it is the locomotive engineers and firemen of America.

Shop Experience before Promotion.

Promotion of firemen to the responsible position of locomotive engineers is a matter of great interest to a very large body of men who are directly interested, and to the public at large, as on the efficiency of these men, and the thoroughness of their schooling, depends the safety of travel.

Many master mechanics think it is best—and no doubt they are right—that a man should have some shop experience, and therefore take boys into the shop as helpers, with the idea of letting them go out to fire in a year or two. The insight that they get to the construction of the locomotive often gets them to thinking that they know considerable more of the mills than the men who originally designed them.

When a young man with a year or two of shop experience starts out to fire a big freight engine on a night run, he often finds that he does not know *all* about locomotives, and he always finds out that a fireman has several other things to do besides ringing the bell and smiling at the ladies on the depot platforms.

Many engineers prefer a perfectly green man to one out of the shop, as the new man will receive the necessary instruction and try and do his duty to the engineer and the engine. As the engineer teaches him to fire first, then to clean, and do his other work, he becomes a good fireman, because he has commenced at the bottom and learned the rudiments only; hence has learned them more thoroughly than the boy who knows, or thinks he knows, how to set valves.

No one questions the utility and improvement that follows from the shop experience; it is the delay in making the shop boy a good fireman and in making him think of his work, not the engineer's.

Mr. Henry F. Colvin, manager of the Rue Injector Co., an old engineer and a man who has had many years' experience in charge of railway shops, proposes a slight change in the usual shop programme, that has several advantages.

He proposes that men be put on to engines to fire first, and learn firing, get their several years of road experience, then be taken into the shop, but still remain extra firemen. Their shop experience, on running repairs, would be intelligible to them then, and do them great good, and the officials of the motive power department would know right where to put their hands on to an experienced fireman in an emergency. Extra firemen going out on all kinds of engines, on all kinds of runs, should be experienced men, and they can be kept on the extra list in no other way. Let shop experience come just before promotion, instead of just before firing, and we believe a vast improvement would be made.

Mr. Colvin's idea is an excellent one.

Unlucky Engines.

There are few men on locomotives who are really superstitious, but many do believe in such absurdities as certain engines being unlucky; where there is one accident there will always be three, etc. A good many of these half-developed beliefs are inherited by firemen from their early engineers. That some certain engine may have had more accidents than others is no reason why she will continue to have them. People who are inclined to be superstitious will be sure to mention the fact that an engine that just fell through a bridge came out of the shop on Friday, if she did, but always forget to count up the other wrecked engines that did not come out on that unlucky day. They also forget to count up the many mishaps that come singly—but let three come together, and then the "I told you so's" are thick. The writer was in the office of a master mechanic once when a young engineer applied for a position. The M. M. looked at him for a minute and said: "I have nothing for you to do unless you want to run an unlucky engine. The 49 has been running less than a year and has killed three engineers, and been rebuilt twice. The boys call her the 'man eater.' She will be out of the shop to-morrow, and not a man on the division wants her." "I would rather have her than any other scrap you have got. I don't believe in spooks," said the engineer.

That engineer is running that engine yet, and her former bad record has been wiped out. A bridge that wants to burn, or a freshet that wants to wash over the track will not wait for the "49," or the "13," or any other certain engine. Don't be superstitious.

If So, Why So?

The discussions of master mechanics, and the experience of shop and road men, as recorded in mechanical papers of the day, tend to show how good one device is, and how successfully it works in one place, and how poorly in others. We can easily see how different conditions of service would change the results, but cannot see why it is that on two paralleled roads, using the same class of engines in the same country and on the same service, one will have perfect success with cast-iron guides, while the other has no end of trouble with them. One finds it cheap and easy to use solid piston heads and snap rings; the other is obliged to use Dunbar or other sectional packing.

One cannot run its consolidation engines without one or more pairs of blind drivers; the other has flanges on all wheels and they do not cut.

One claims to save oil and repairs by the use of sight feed lubricators; the other says they are not worth using, and not reliable.

We do not believe this is because the engines are "cranky" or object to any new-fangled arrangements on them. There must be a good, practical common-sense reason "why these things are thusly."

The reason solid pistons do not work on some roads may be found in the style of crosshead in use; it may not be so proportioned that it helps to keep the piston head up off the bottom of the cylinder, or some other similar reason. The reason the cast-iron crosshead, or cast guides do not work, may be found in the design, insufficient bearing surface, or in the quality of the metal itself.

The lubricator may be troubled by poor or dirty tallow, or the engineer with ignorance or prejudice. Don't be superstitious, don't believe that anything about your engine is so unless the "why so" is proven.

Get at the bottom of these things—study, talk, write. "In ignorance there is bliss" was not written about railroad men.

ASKED & ANSWERED.

(15.) R. R., Plattsmouth, Neb., asks:

What is a scab? *A.* Railroad men call a man a scab who takes the place of a man who is striking or in trouble about wages. A man who works for under pay. A man who defeats the aims of workingmen in demanding good pay or fair treatment.

(16.) J. J., Leadville, Col., writes:

I run an engine with small wheels, and I notice that center of cylinders are higher than center of driving wheels. What is the object, and how does it affect working of the engine? *A.* It is generally found desirable to raise the cylinders two or three inches to get them up out of dust and snow, and when the engine rolls the frame is thrown down, bringing the center of cylinder about on line with center of driving-wheel. Its most noticeable effect is on valve motion; provision is always made to meet this.

(17.) O. N. T., Delphos, O., writes:

I am firing an 8-wheel engine, Rhode Island build. When she first came from the works she was so logy or slow you could hardly get her started; now she is the quickest engine on the road, and she has never had anything done to her; in fact, has never been in a round-house or shop since she was built. Can you tell me the cause, as her lead has never been changed? *A.* The engine was probably fitted up so nicely that she was stiff, and the friction of her own parts made her slow to start. It requires six to eight times as much steam pressure to start a new engine as is required to start an old one.

(18.) Student, Topeka, Kan., writes:

Our road has had the automatic brake for years, but we have not used it, always using the straight air until recently. I notice now that with eight or ten cars, when we use the brake quickly, that the head car or two and the tender brake will *release*. I cannot understand this. *A.* The shock caused by closing the three-way cock too quickly, thus checking the flow of air, increases its pressure at the front end of the train enough to force the triple valve piston up and release the brake. In using the automatic it is best to *open* the brake valve quickly and *close* it slowly. If you use the later design of engineer's brake valve instead of the three-way cock, it would obviate this trouble, as it cannot be closed so quick. Engineers like the old three-way cock because it handles easier.

(19.) W., Broad street, Philadelphia, asks:

Why is the back of many locomotive tenders made like a wedge? *A.* To enable men in cab to see switchmen on ground behind the engine and to make it easier to get over. Only yard engines are so built.

(20.) Elevated, Brooklyn, asks:

Why is the vacuum brake better for roads like the "L" than the air brake? *A.* It is quicker to act and release, having almost no friction at all in its working parts.

(21.) Reader, N. Y., asks:

What is the composition of the Mason locomotive bell? *A.* The bell mentioned is composed of four (4) parts of copper to one (1) part of tin.

IN THE ROUNDHOUSE AND Repair Shop.

The B. and O. still use the old clamp screw coupling on air hose—the same as they used with the Loughbridge air brake, before the introduction of the automatic.

***

Pittsburgh engines have the steam chest casing and cover in one piece, cast to fit the place, with round corners, and no creases of fringe to collect dirt and grease.

***

The Reading road are having a number of engines built at Baldwins that have a large fire-box, but only about half the size of the Whooton. Has same grate surface, but no combustion chamber.

***

Readers who do not find THE LOCOMOTIVE ENGINEER on sale at the news stands where they are accustomed to trade will confer a favor on us by dropping a card to this office, giving location of stand.

***

Some of the new roundhouses in the East are heated by large radiators between the stalls. The old idea of placing all the steam pipes in the pits was a good scheme to cook oil from about October to May.

***

H. K. Porter & Co., builders of light locomotives, at Pittsburgh, Pa., do a large trade in rebuilding engines for firms who have no shops. They had an engine in the shop, the other day, that was burned. She came from the pineries of Michigan.

***

D. Clark, designer of the Clark valve motion, at Hazelton, Pa., uses a throttle whose stem enters side of dome and is worked by a bell crank. The throttle lever in cab stands up like a young reverse lever, and is just behind that lever on side of boiler.

***

Consolidation locomotives have a long extension of the frames from the back box to the tail piece, also from front box to cylinder saddles. Engines are now being built with a cast wedge fitting between these frames for some three feet, and strongly bolted in.

On L. V. pushers they use a pony truck with a pair of heavy flat coil springs set immediately over the truck box. It makes it possible to shorten the front frames, allowing short enough buffers to prevent them from passing and locking with those on cars on heavy grades.

***

In answering Question 12, last month, we made a mistake in saying the mark on box should be placed *above* mark on frame. A moment's thought will show why it should be placed *below*; as the box wears, the frame, boiler, etc., settle down; the wheels or box do not work up.

***

Wm. H. Hubbard, foreman of the D. & R. G. shops, at Pueblo, Col., gives our readers the benefit of one of his shop kinks in this issue. Mr. Hubbard enjoys the reputation of making some of the most perfect rings at the least expense of any shop on his road. Such kinks are just what we like to get hold of.

***

The variegated, complicated and intricate signal system of some of the big 2, 3 and 4 track roads of the East looks Greeky to a Western engineman off a single track road, but put an engineer of the Pennsylvania or New York Central on to a Western line, and the time card, book of rules, "rights, etc.," is just as hard for him to understand.

***

It is strange that so many repair shops, locomotive works, etc., are equipped with such poor blacksmith shops. Crowding work into small forge shops and requiring forgings to be got out in a hurry to keep men busy in other departments is bad policy. The blacksmith shop is the foundation for the machine shop, and is as important as the foundry.

***

One of the "fast line" engines on one of our New York roads recently broke down on its main line and "held everything," for nearly three hours, all because the solid rod was held on by a loose collar that had concluded to stay, the end of the pin having been badly battered. Had the collar been in the shape of a nut it could have been forced off.

***

The Pittsburgh Locomotive and Car Co. are building 25 large 10-wheelers for the Atlantic & Pacific. They have 60-inch boilers with an 8-foot fire box, extension fronts, rigid front trucks, and tenders with a capacity of 4,000 gallons of water. They have solid-ended rods, Krupp tire, air brakes, comfortable cabs and good paint. They weigh over 100,000 pounds, 90,000 of which is on the drivers.

***

We notice some of the large consolidation engines over in Pennsylvania have both ash-pan slides arranged to pull *back* instead of to one side; they are connected together by a rod, and a lever on the back one opens both. Slides that open to the side are hard to get around to clean pan, and if the wind is strong on one side, it is often a great privilege to pick sides.

***

It is too bad the Rotary Snow Plow Co. did not have one of their rotary snow shovels to send out during the blizzard, to show its range and practical use, in the East. We have very flattering reports of its work in Montana and Dakota. The recent storm found several thousand miles of road without a single plow. Some of the roads had an engine or two with a little boiler-iron shield on pilots, that the boys out West call a "weed cutter."

Engine truck wheels, especially pony trucks under consolidation or mogul locomotives, would be very much handier if a spoked wheel were used. It is almost impossible to pack or oil these boxes where a solid wheel is in use.

***

Railroad men, young or old, cannot do better with their savings than to invest them in real estate; get a little home, stick to it if you move away, rent it; buy another and pay for it as fast as you can, you will soon own two. A little rent coming in every month will be a big help. It is easier to save money after you have made a start. Make the start.

***

A great many of the engines in the East have a neat, black painted board clamped to hand rail just back of the stack. It can hardly be noticed from the ground. It is very handy to paint or repair the stack, and keeps the men who sand up the engines from standing on the jacket and scratching up the paint work on the sand box. It is also very comfortable when you have to crawl out on a stormy night and dig down real estate.

***

One man runs and fires switch engines in the Cumberland (Md.) yard for the B. & O., and receives therefor but $2.50. Some day one of those old camel-backs will kill somebody, because the engineer could not see both sides of his engine, and the company will have to pay heavy damages; but this will not pay for the loss. There should be an international law, that at least two men should be on all locomotives. It is dangerous enough then.

***

If a man wants to see some old veteran engines, that ought to be pensioned, he should go over to the B. & O. road. The old "camel-backs" are improved now over what they once were, but are very crude affairs yet. They have old slab frames, no wedges, cast-iron tires, small sloping fire boxes, a low deck or "pit" for firemen to stand on to fire, old half-stroke pumps back of fire box, cab above boiler and large dome in it, no lagging or jacket on boiler, a lever to open smoke arch door to keep her cool, bell on boiler back of cab, Loughbridge air brakes, steam scales, eccentric throttle movement and a thousand other old schemes. They have injectors now and steam gauges, and link motions; they used to have hook motion and some of the old gear is retained—especially the old heavy cast rocker arms.

***

The B. & O. have a few old Perkins camel-backs still at work in its odd corners. We noticed one at the Cumberland Rolling Mill. These engines have the cab well back, more like an 8-wheeled engine than the old camels. They are equalized on four 20-leaf springs of heavy pattern. They have 8 wheels connected and no trucks; the wheels are small and have cast-iron tire. There is no cylinder saddle, each cylinder being separate and bolted to the center of the smoke arch and laying at an angle. All the rods are round, and the main connections are on next to the back pair of drivers; the back end of main rod has a knuckle joint and the side rod to rear wheel is connected to it. The main rod connects next to wheel, and outside of it the side rod to pair of wheels ahead is placed, and from the forward to next pair of wheels another rod is used; thus each connection is independent, except back one, and that is tied on to the main rod. These engines formerly had hook motions, but now have links, connected through two pairs of rockers and any amount of hangers and reach rods. These old pelters make a man think of his great-grandfather.

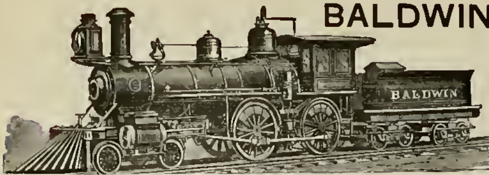
And now, as a fitting sequel to the headlight war that has been raging for the past year and a half, some of the manufacturers are talking of organizing a pool, or trust, or whatever they may choose to call it, for the purpose of putting up the prices of locomotive headlights. Of course the natural result of this course will be to stimulate competition in the manufacture of the goods. Perhaps, too, if the prices should begin to go up, quality may cut more of a figure than it does at present.

***

A MANUAL OF STEAM BOILERS—THEIR DESIGN, CONSTRUCTION AND OPERATION. By PROF. R. H. THURSTON, of Sibley College, Cornell University.

This book is a very complete treatise on the steam boiler; beginning with the history of the earliest contrivances, and giving accounts of all developments in steam-generating devices from the first to date. Every style of boiler is illustrated and described, and its advantages and disadvantages pointed out. A vast field of experiments in construction is reviewed and the causes of failure and explosions are gone into very fully and very plainly. The book is exact and complete enough to be used as a text-book in schools of engineering, and yet is so eminently practical that it must impress the mechanic as being, for his purposes, complete and reliable. Prof. Thurston has had a better chance than almost any other man in this country to study and experiment with steam boilers. The book would make a first-class reference for any mechanic desiring such a reference.

The price is $6.00, and they are for sale by the publishers, John Wiley & Sons., 15 Astor Place, New York.



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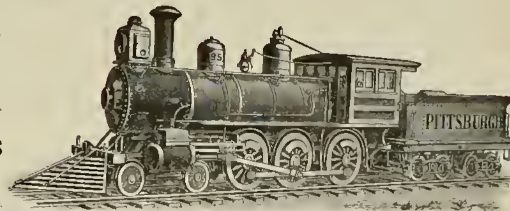

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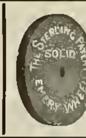

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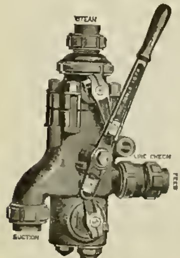

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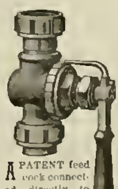

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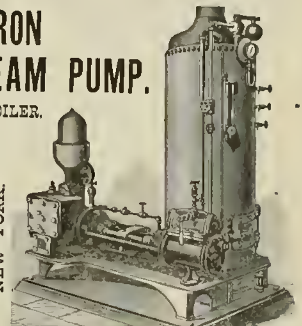

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VOL. I. NO. V. NEW YORK, MAY, 1888. $1.00 per Year, or 10c. a copy.

A New Reverse Lever.

The reverse lever shown on this page is the invention of George W. Cushing, Supt. M. P. & R. E., of the Philadelphia & Reading Railroad, Reading, Pa.

It will be seen by a glance at the cut that this lever is designed to give just what the locomotive engineers of the country have been wanting—a reverse lever that could be instantly thrown from full gear forward to full gear back, or *vice versa*, by the use of a latch, same as now used, but still allow a very close adjustment.

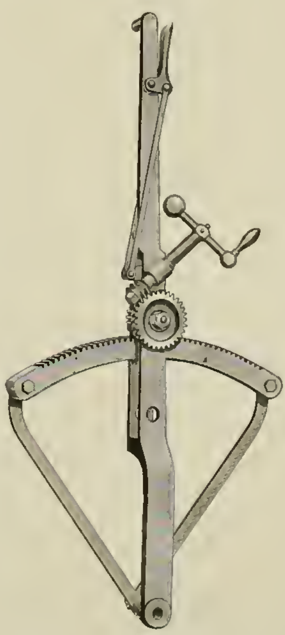
Mr. Cushing seems to have met this want very fully in the present invention. The quadrant is cut full of teeth, instead of notches, into which a small gear meshes. This gear is located between the two sides of the lever, and is shown just behind the worm wheel, which is on the end of same shaft, and shown fully in cut. The worm on the handle engages the teeth of this wheel. This worm shaft is held by a box on the side of reverse lever, and its axis or shaft goes through the lever and is secured by a nut. In the center of the shaft is fastened a short crank arm, and to this arm the long links are attached below, and reach to the thumb latch above. It will be seen that if the thumb latch is pressed to the lever the worm will be tipped out of gear with the worm wheel, and the lever can be thrown to any position as quickly as can any reverse lever. For comparatively short movements the handle is rotated, and the point of cut-off is as closely regulated as any man can wish.

Another thing will strike the observing engineman; the gear in the quadrant can be easily kept tight, and the worm, being on a taper, is always tight, doing away with the lost motion and chatter of older devices.

The desired results seem to have been simply and cheaply reached.

The Water Hose Trouble.

One of the meanest acting little details of a locomotive is the water hose from tender to feed-pipe of engine. The usual design has a "goose-neck" fastened to the leg of tank by tap bolts through a flange on said goose-neck; this is, of necessity, very close over front wheel of tender trucks, and is in the way of air hose, steps and brake rigging. The working of the brake works the joint loose, and to tighten it up on the road is next to impossible; in winter the leak covers the wheels and running gear of tank in an overcoat of ice; the hose "kinks" at its shortest turn and finally breaks there, shutting off the



supply of water; it is stiff and mean to connect or disconnect, and altogether an undesirable scheme. The B. & O. have the goose-neck attached outside of tank frame and back of the step; if it leaks a man can get at it by standing on the ground; it requires a little longer hose, but there is no short kink in it; the brake cannot touch it, and it looks—to a man who has been lying on his back trying to reach a rusty bolt in a hidden corner, while a stream of water ran down his arm and froze on his funny bone—like a blessed good thing.

Side Rod Cups.

The writer recently rode over one line of road and found the engines well supplied with modern appliances. We talked with an engineer on a freight consolidator, and he was in a stew because some of the needle-feeders—glass cups on the side rods—were not doing just right. We went right over onto another road where consolidators are in use, and rode on one; there were no cups on the side rods, and never were, there was only a drill hole, and the engineer spilled a little black oil around this hole when he oiled the rest of the machine. There is a good deal in the way a man is brought up how he takes these things. We are for side rod cups, because we are used to them, yet the men who don't have them seem to think a simple hole is good enough for a side rod.

Kicking Against the Wrong Thing.

We recently ran across an old-time engineer, and he was very busy cursing the right hand injector, and wishing he had his "good old pump" back again.

Investigation proved that the throttle or steam valve attached to the injector was leaking so badly the instrument could not prime. By leaving it wide open and using the steam valve next to the boiler, it worked all right; good enough for one trip. Injectors get blamed for many mysterious tricks that are really the antics of throttles, primers, checks or hose strainers.

The modern injector is one of the best, if not the best, improvements put on locomotives since they put on a stack to carry off the smoke, instead of having the fireman catch it in a bucket, and carry it out and dump it in the ditch.

We are in receipt of photographs of the Rotary Snow plow at work in the drifts of Montana. Makes a man shiver to look at the way nature lavishes the beautiful out there.

Locomotive Feed-Water Heaters.

We are in receipt of several questions about the work of feed-water heaters on locomotives, and asking us to explain certain things.

One correspondent from Canada states that he ran an engine some years ago that had a feed-water heating device, through which the right hand pump fed water; this heater was a coil of pipe on the inside of front end. He states that, with this pump, the water was so hot that a person could not hold the hand on feed pipe, but when the engine was at work the hardest, he could shut off this hot water pump and put on the left pump, that pumped cold water direct from tank to boiler, and it would make no perceptible difference in the steaming of the engine. He is at a loss to know why hot water is not better than cold water to feed a boiler, and if heaters save from 10 to 20 per cent. on a stationary boiler, why they don't on a locomotive.

A locomotive is altogether a different case from a stationary engine and boiler. The stationary boiler has a natural draft, and the engine exhausts into the atmosphere; if heat can be taken from this waste steam and returned to the boiler in the feed water, it is a clear gain.

On a locomotive the exhaust and all the heat in the front end or smoke arch is used to create a draft. If we take out a certain quantity of heat and return it to the boiler we have robbed the steaming capacity of the boiler just this much; we have lost one place to gain in another; we have taken a sum of money from one pocket and put it into another. If we take out exhaust steam to heat the feed water we rob the exhaust of so much heat, and hence have gained nothing.

You cannot take out one degree of heat from the front end without a loss. Locomotives are now crowded in every possible way to make steam enough to do their work; to take out heat from the front end in any shape means to further contract the nozzles to make up for the loss, smaller nozzles means less work exerted by the engine to pull her train, and more to burn her fires. Work is heat.

We have yet to hear of a single feed-water heater that has let the engines work at anywhere near their full capacity with larger nozzles, yet they all claim to save fuel and reduce back pressure.

Where any saving has been shown we are convinced that it is where the locomotive was not worked to anywhere near its full capacity.

The successful locomotive feed-water heater must take the heat from the gases after they leave the stack. Taking it any place between the fire-box and the top of stack is robbing Peter to pay Paul.

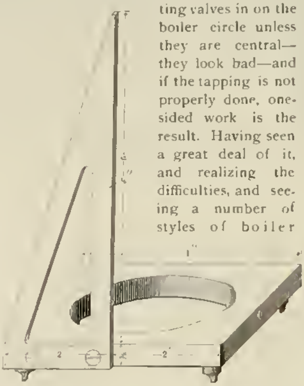
An Example.

The London and Northwestern Railway, of England, has 55,217 employes on its staff. With one of the fifty-cents per-month hospital schemes of America, the yearly receipts from this quarter would be the neat little sum of $331,302 "Hospital fund" is railroad English for a "hold up."

Handy Boiler Square.

BY WM. FOSTER.

I send you a print of a boiler square which I made, and which has proved a good tool. There is great difficulty with the average mechanic in drilling holes in a boiler to get them central, and in putting valves in on the boiler circle unless they are central—they look bad—and if the tapping is not properly done, one-sided work is the result. Having seen a great deal of it, and realizing the difficulties, and seeing a number of styles of boiler



squares, all imperfect, for the reason of the difference in the size of boilers, necessitating a different square for each size To overcome all difficulties I made this square, which will enable anyone to drill holes and tap them central with the boiler. The sketch explains itself, the projecting feet on bottom being of equal length, when placed on the circle of the boiler, squares itself, as the tongue of the square is exactly in the center and square with the feet. Now if the tap is brought on a line with the tongue of the square, it will be right every time.

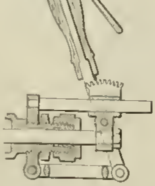
The sizes in inches are given on the drawing, so that any mechanic can make one.

One other advantage this square has, it can be used on any sized boiler, from 10" up to the largest size.

Providence, R. I.

New Valve Handle.

The cut shows an attachment to lever valves, whereby they can be held in any position. The idea was gotten up for throttle valves of injectors, and is in use on a number of roads, the B. & O., and the Canadian Pacific especially. This lever and arrangement can be held at any angle or be worked upside down as well as any other way.



We are indebted to Eugene V. Debs, editor, for a bound volume of the *Locomotive Firemen's Magazine* for 1887. The *Magazine* is the ablest labor organ in America.

Cure for Leaky Lubricators.

The tramp editor was taking an inventory of the inside of a locomotive cab the other day, and his attention was called to a new style of air pump lubricator. The device had no internal pipes, but drilled holes through solid casting; the holes were straight and a small iron screw was tapped into them, so that a wire could be used to clean out the passages. The oil used contained plenty of acid (the fireman said it was composed of sun-cured mule oil and old rubber boots), and its action on the fine thread of the iron screws was seen in the leaking indulged in around them.

The engineer said that all the cups that had run a month or two had blown out a screw if they were not removed soon after commencing to leak. Tapping out the hole and putting in a brass screw cured the disease.

Burlesque Examinations.

There is scarcely a road in the country where the engineers and conductors do not have to pass an examination. This examination is generally conducted by the division superintendent, and in half the cases might just as well have been omitted.

Division superintendents are made of all kinds of timber—conductors, station agents, office men, etc., and, except in the case of the first mentioned, know nothing of road service; the ones who know the least are the ones who want to appear to the men as the cutest—a sort of railroad encyclopædia. They get hold of and learn by heart a lot of difficult and unlikely problems, and spring them upon the unsuspecting victim.

If the practical man undergoing examination asks a knotty question the official looks wise, and asks: "Don't you know that? Well, now you think that over and let me know how you figure it next trip"—he wants to consult some oracle himself.

One local big-wig, whom the writer stumbled across in his experience, was in the habit of getting young men up in his office and propounding some of his tangled problems. If the answer was right he would look the young man in the eye for a second, throw down his book of rules, pick up his pen and say: "If that is all you know about railroading *we* can't use you on *our* road." If the now rattled man would start to go the superintendent would call him back, and, without telling him that his answer was right, go for him again. There was at this time a young man throwing coal into one end of a big boiler that the writer was taking out at the other, *via* the exhaust. One morning he got a notice to wash the coal dust out of his ears, pull off his overalls, and stand in the august presence of Himself for examination for promotion. That night he bearded the lion in his den, and the writer slipped into the roadmaster's office next door, to hear what was said. Himself wrote about ten minutes after the candidate arrived—this to get him nervous. He finally read his note from the

M. M., and settled himself to do the youth up—but he didn't.

He fenced a little and finally asked:

"What is rule 18?"

"The rule is rendered useless by rule 93," said the fireman.

Himself commenced to thumb the leaves of the book of rules, and the fireman asked:

"What are you looking for, rule 93?"

"Yes."

"Well, there is only 84 rules in the book, and besides that, I don't know a single rule by its number, and I see you don't. Take a train or engine on the road and cite any case or complication that can come up, and I will tell you what I would do. Now in the case of the wreck last week, both crews think they were right, and so far the men are about equally divided. Now I am a little shaky to know which side is right; I think the man coming East had the right of the road, don't you?"

Himself could not decide that, as the case was before the general officers.

The candidate asked that his examination be deferred till these cases were settled.

Himself couldn't do that.

Then the victim pulled out a book of rules with a dozen rules checked, and asked light in each case, but he didn't get any. Then he pulled out a division time table—made up by Himself—and pointed out several conflicting rules and as many fatal blunders in the time table, and wanted more light, but he got a certificate of examination, with the parting injunction to "run slow."

Himself had not asked a question but had been asked many, and he could not answer one.

While the writer was wondering to himself what earthly use such jim-crow examinations were, the victim came out with the flush of victory upon his cheek, and ye scribbler fell upon his neck and wept tears of great joy.

Tallow Pots.

There are few enginemen who will not recognize their own tallow pots in the photos given below. Fig. 1 is a bird's-eye view of the inside of a standard tallow pot, furnished by a well-known locomotive works, and in use on dozens of different roads; it is about 14" long by 4½" or 5" square, with a loose cover in the center, a small spout at one end and a small handle at the other; it is not, as a rule, provided with a strainer, and was intended to use where valve oil is used instead of tallow. The builders send out an iron bracket that just fits the tallow pot; this is sometimes bolted to the cab, and at other times to the boiler head; in either event, at each lurch of the engine it pumps out a small quantity of oil. To handle it is like a man trying to carry an axe with the handle horizontal and the weight extended far out in front, by main strength. As a tallow pot, it is not a thing of beauty, or much use either. Fig. 2 is a step-brother of Fig. 1, but is shorter and larger other ways; it generally has an inclined perforated sheet of tin in front at *a*, that gradually gets full of dirt and stays full, as there is no way to get at it. They slop over easily, and when they are half full of unmelted tallow you can't use half the stuff that will run. The stiff, pasty lumps slide down and shut off the screen holes. Then the engineer or fireman gets in a hurry and sticks the spout under overflow of injector or waste of air pump and tries steam as a melter, generally succeeding in blowing off the cover and getting a

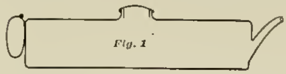


Fig. 1

shower bath of possum fat, condensed steam and foul odors. Then they get a shovelful of hot coals and set the little refrigerator on that, or set it in the fire door; this melts the tallow, and generally the spout or handle fastenings. Some roads use this same pot with wire bail, which is of some use, not much.

Now, what is wanted on a locomotive is a tallow pot that has a large bottom surface to insure its melting the tallow easily; it wants a handle that a man can hold on to and keep the pot right side up with a greasy hand, and no other effort than to sustain the weight; one that has a strainer that can be taken out and cleaned, one that will not slop over at every lurch of the engine, one that can be cheaply made, easily repaired and easily cleaned, one that can fall without break-

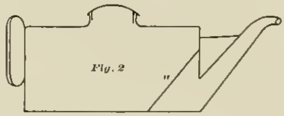


Fig. 2

ing off a handle or spout, and one that can be set in the fire door or on a scoop of coals with only one inch of grease in it and not melt something.

Such a tallow pot can be found in Fig. 3. The top is pressed tin, the filling cap is well back, so as not to waste tallow there when pouring from a full pot, the spout screws into a brass nut soldered into the top of pot in front, and to the bottom of spout is soldered a cone strainer, easy to take out, clean or repair; the handle is made of cast brass or of wood in a pressed tin depression; it can't be

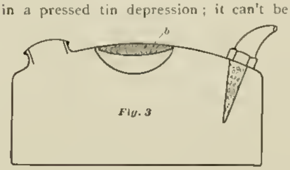


Fig. 3

knocked off, melted off or bent; it is close to the weight and easy to handle; it gets hot, perhaps—all of them do—but it is just as easily cooled. Because the old tallow pots have been made like 1 and 2 for years is no good reason why they should always be made so.

On eight-wheeled or open cab locomotives there is generally a small shelf on boiler head over the fire door, to carry the pot; as this is generally narrow the pot may have to be made oblong to fit it; on engine where boiler comes through the cab a good practice is to cut a hole just the size of the pot through the jacket and lagging, and fit a neat rim into it, letting the tallow pot set directly on the boiler sheets.

How and Why Injectors Work.

We are in receipt of many letters from practical men on the roads, asking for some plain explanation of an injector. Almost every one states that the writer has read or studied the principles in books, but is not up in terms and mathematics. One says: "I know an injector when I see it, but I don't know any algebra, and I don't know anything about foot-pounds, initial pressure, latent heat, etc. Would an injector work with compressed air as well as steam?"

The ground has been gone over many times by able men, but we will try to make the principle plain to the practical men whom we address. In the first place, no work is done on earth without heat. The exertions of the horse or ox are only accomplished by the use of heat. It is the heat of the sun that causes the grass to grow and the corn to ripen; it is the heat of the sun that draws the water from the earth and returns it in rain, or that sends down the streams from the mountain that turn a hundred water wheels. It is the heat of the sun stored up for ages in the shape of coal that we burn to-day. Work requires heat; heat, properly directed, is work. An injector does work, and to do it, it expends heat.

Compressed air will not work an injector, because the air would not condense on coming in contact with the water, but remain air, prevent a solid jet from being formed, or maintained after it was formed. There are many kinds of injectors, but all are essentially the same in their working parts. A non-lifting injector is different from a lifter only in wanting attachments to lift the water to it. The fixed-nozzle injector is one without moving internal parts, and differs from the adjustable instrument in the method of controlling the range of work only; the principle on which they all work is the same.

Steam issuing from an opening in a boiler travels at a very high velocity, while water escaping from the same sized opening will travel only about one twentieth as fast; this is due to its greater weight.

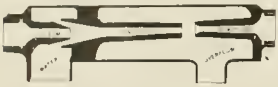
The simplest form of injector is shown in the cut; and water must be supplied to it either by placing it where water can flow to injector or be brought to it by lifting jets.

Suppose water flowed to this instrument, it would fill the space around the steam nipple and flow through the combining tube and out of the overflow; it cannot flow into boiler, because it has not force enough to lift the check. Now if steam is admitted in small quantity it will force its way through the combining tube and carry considerable water with it; it would produce a current that becomes stronger as more steam is admitted, until the velocity of the steam, combined with the weight of the water, will form a jet that has sufficient weight and velocity to cross the space between the combining and delivery tube and force its way through the latter to the boiler.

The steam, by coming in contact with the water, has become condensed, and in imparting to the water its velocity has lost its heat, or most of it. If more steam is sent to the injector than the water can condense, air will be drawn in at the overflow up to a certain point, then steam and hot water will issue from the overflow, the steam through the combining tube will be hotter and less solid, until the velocity will be out of proportion to the weight, and the injector will break; on the other hand, if more water is supplied to the instrument than the amount of steam supplied can carry with it, the surplus water will escape at the overflow.

If a pound of feathers were shot at and struck a house with a velocity of 1,000 feet per second, it is not likely that it would do the building so much harm as a pound of iron would, traveling at the same velocity.

Water from the boiler will not work the injector, because it has not the velocity to impart to the water to be fed. The steam can only do the work by sacrificing heat and velocity to gain weight; or, in other words, it has sacrificed heat and velocity to pick up and carry with it a certain amount of weight in water.



Experiments show that with a boiler having a pressure of 100 pounds, that from an inch opening in the steam space steam will flow at the rate of about 1,870 feet per second, while from the same sized opening in the water space water will flow at but about 100 feet per second. These figures may not be exactly right, but the proportions are nearly so.

If, for example, we assume that the steam is condensed until it consists of but ⅛ of the amount of heat and water returned to the boiler, we will find that it has taken up the other ⅞ in water. It has gained that proportion of weight and has lost a corresponding amount of velocity, which, in this case, would reduce the velocity to about 234 feet per second, leaving out all fractions, which velocity has to overcome the 100 foot velocity that would issue from the raised boiler check if there was not the stronger jet rushing in to overcome it. It is plain, from this condition of things, that an injector would force water into a boiler of even greater pressure than that from which it took steam.

There are exhaust injectors that work, using steam from an open exhaust pipe with pressure only equal that of the atmosphere, but it will not work with certainty at boiler pressures above 70 pounds per square inch. The reason for this is that steam at atmospheric pressure flows at a slower velocity than at higher pressures, though the velocity does not increase in the same proportion as the pressure, and its imparted velocity is but little above the resisting pressure at the check.

Fastening Shoes and Wedges.

Early locomotives had no wedges to take up lost motion between driving boxes and jaws of frame, and so the men who ran, repaired, designed, built or owned those locomotives had no trouble about holding wedges in a certain place. Their trouble was because they had no wedges or any other means of taking up the "thump."

When wedges were invented they had no wings or side pieces, and to hold them in place sideways they had a rib on their backs and a slot in the jaw of frame for it to work in; they were held in various ways, but one of the first was a tap bolt, top and bottom, but the top one was always getting on the time of a spring hanger or something, and had to be pulled off. Some of those old wedges are running yet; they have different ways of holding them, but the rib is there and the sides are gone, and the sides of the boxes have chawed a slice out of the jaw on each side, as a trade mark, or else to show that the frame belonged to the box.

After awhile some one stumbled on to the fact that wedges and shoes could be made cheaper than frames, and then commenced to make wedges that went each side of the jaw. After this they schemed for some way to hold the wedge after they got it there, and their schemes are holding, or trying to hold, in dozens of different shapes, all the way from Sweden to Missouri.

There was the plain little old bolt that was screwed into the bottom of the wedge and was fastened with a pin; it stuck through a larger hole in the pedestal brace, and had a nut top and bottom. It held the wedge from wandering around, but the top was loose, and the nut on top of pedestal brace was hard to get at, especially on the boxes next to eccentrics. Then they screwed the bolt into the brace and put its T head into a T slot in the wedge, and held the bolt by a jamb nut; the wedge soon elbowed around till it got room on top of that T idea.

Then they drilled a hole through the back of frame; yes, even made a slot, and put a bolt through there and into the middle of the wedge, but the driving box was bigger than the wedge bolt, and the latter, believing that discretion is the better part of valor, slacked off. Then the wedge danced around again, and, having nothing else to do, enlarged the T slot.

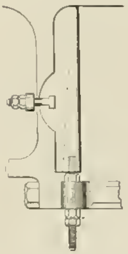
Then the box "thumped." Then the engineer "set up the wedge," and oiled around. Then the box worked up and down and hugged the wedge, got warm and expanded and hugged harder, and finally, at a bad frog, the box went up, and the wedge went up, as far as the slack in the T business would let it, and it stayed there.

Then that engineer sawed blocks next time, and, when the wedge had been screwed up where it belonged, he put the block under and screwed *down*. The T scheme was gone, but the top of the wedge was loose, and everybody said that was a bad idea, but it couldn't be helped.

Then the fellow who got up the cast-iron thimble, in place of the pedestal brace, came along, and, as he had a bolt through the middle of the thimble, they couldn't hold the wedge up by a middle bolt, so they put one each side. By getting the wedge where it was wanted, and jambing one bolt up and the other down, the wedge couldn't move lengthwise, but it wouldn't hold its tongue at the top of the box. They put in the gag bolt through the frame, but she spit them out; or, if they were located where the stopper and starter couldn't possibly reach them with a wrench, she took the lockjaw and held on to them for dear life.

All these schemes are in use, right in this country, now. What is wanted is something to hold the wedge where it is put, solid, and some simple way of raising and lowering the wedge. There is often as much necessity to draw the wedge down as there is to force it up.

The back tap-bolt is in general use to hold the wedge against the jaw, but is very unsatisfactory, especially on roads using small-wheeled engines.



William Wilson, Superintendent of Machinery of the Chicago & Alton Railway, designed and has in use a very efficient device for this purpose. The sides or wings of the wedge and shoe have a projection, and in this a T slot; T-headed bolts hook into the wedge each side of the frame, and a piece across the frame makes an efficient clamp. If there is a brace or bolt in the way the bolts are made a little longer and the clamp put on top of the projection. It is about the surest thing we have seen, and its simplicity and get-at-ability recommend it above any of the older devices.

Economizing Pieces.

A few years ago locomotives had only a few attachments; there was little in the cab but a lever, a throttle and a fire door; now there are few boats running but what are fitted with most of the new devices for oiling cylinders, pumps, etc., from cab; air pumps have added many handles, injectors, and all the smaller attachments have made the locomotive more complicated, but more efficient. To offset some of this, there are now many castings made alike for both sides of the engine. Years ago if an eccentric strap was broken an order would call for a "left forward" or "right back," and that meant entirely a different casting than the others; now many builders cast their straps all alike.

Then all the change that is called for from one side to the other is to drill the oil hole on the proper side. This calls for but one pattern for this piece, thus they are cheaper; it also calls for a smaller stock of castings to be kept on hand.

Right and left hand cylinders are now cast from the same patterns, both ends being alike.

Many steam chests were made with the stuffing box out of center, and a pattern for each side was deemed necessary, but it was soon found that if the gland was placed in the center of the chest, up and down, it would work just as well on the

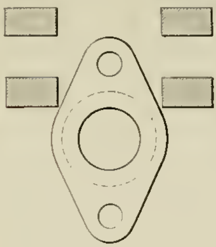


Fig. 1.

other side, turned over. Solid rods are throwing away many pieces about side rods ; solid piston heads have exiled bushels of small pieces from our cylinders and injectors, and inspirators have retired thousands of trappy pumps from active service.

It is good practice to never use two pieces where one will do the work ; it is poor economy to use two patterns where slight changes will let one pattern make a piece fit either side.

The Water Brake.

Some one expressed a desire to know how this simple device worked some time ago, and the answers from correspondents in the journals that published the questions are very conflicting.

We notice one thing, however, that is some satisfaction, and that is that all the men know how to handle the brake ; they invariably state this part right. This is the trouble all over the country, the men know how to handle many devices, but don't know why the devices work. That they could reason out failures far better if they did know goes without saying.

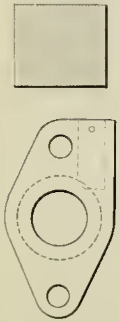


Fig. 3.

One man writes clear from the sunny land of the Montezumas to tell the readers of the *Engineer's Journal* that the water pipes are tapped into the steam-ways in cylinder saddles. As a matter of fact, the pipes enter the exhaust passages, and the water is drawn into cylinder by the engine being hooked back of center while running ahead.

The Reading Railway Company use gas lights in their new cars. It is carried in a steel cylinder under the car, and compressed to 1,500 pounds per square inch.

Piston Glands.

There are about as many different kinds of piston glands as there are railroads—more or less.

Four-bar guides that are so arranged that the piston is below them—and most of them are so made, because the lower inside guide is in the way of the truck wheel —are usually fitted with a gland like Fig 1 or Fig. 2 ; single or beam guides generally call for a gland like Fig. 3, or one without the oil hole attachments.

In nine cases out of ten, if . and works off, and they often do, the first stroke of the crosshead finds the gland partly turned over, drives it against the studs, stripping the threads, bending or breaking studs off, or breaking the gland itself.

Where the piston is in the center of guides, a large gland, like Fig. 4, is a good pattern ; it can come off if it wants to, but can't get out of shape or strike the studs, and the nuts are away from the guides and easy to get at. This style, or one very much like it, is in use on the B. & O.

Where the piston is below the guides, a gland like Fig 2 is often used, and where

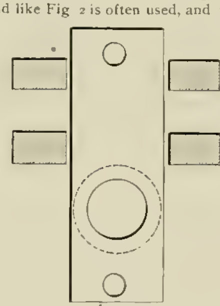


Fig. 5.

so arranged should be fitted close enough to guides to prevent its turning enough to strike studs in case it came off ; the long gland, like Fig. 5, is good, and easier to get at. The losing of a gland nut or stud is a very common occurrence on many roads, and if a form of gland can be used that will make such incidents no more costly or cause no more delay than the replacing of a few nuts, it will pay to make the change of glands as the engines go into the shop

Practical or Nothing.

Engineers and firemen in England are "kicking" against a bill that has been introduced into parliament providing for their examination and carrying certificates. Something of the same nature has been disturbing the enginemen on this side of the water. If the law will provide that all examinations be actually made on the road, that no employe shall be asked to distinguish shades of color, but only flags and lamps used by the roads, that all rules about brake handling shall be made where the candidate can actually handle the brake, that all examples of train rights shall be cited on the road and division of the road with which candidate is familiar, and numbers of trains be numbers of trains actually on the road ; that examples in fine-drawn theories be abolished, and only practical questions that *could* come up, where candidate would have to act, be asked, we will guarantee that the enginemen of this country (or any other) will safely pass.

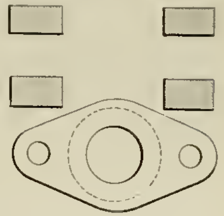


Fig. 2.

Deep-laid schemes of railroad puzzles and color-blind dead-falls would catch almost any man. If no official examiner was allowed to examine men whose engines and runs he could not himself care for, there would be few of the boys "stuck"

An Undershot Snow Plow.

The inventor of a new rotary snow-plow shows up an imaginary and ideal half-page cut of his invention in one of New York's railroad papers. The picture shows the excavator wading along in about four feet of snow, and sending a solid stream of ice and snow clear over into the next township. The wheel runs in front of the plow, and looks for all the world like the stern of a Monongahela river steamer, the wheel having vanes and paddles, being some nine feet across and about the same in diameter, running "under," and is supposed to throw the snow out at the top. It looks to a man who has pushed snow plows in a country where they have snow, as if good-sized drifts would fill the wheel up solid, and then at the first ice-spot lift it off the track. Every obstruction that it strikes must go under.

There has been a number of good articles and interesting queries come to us during the month that we were loth to

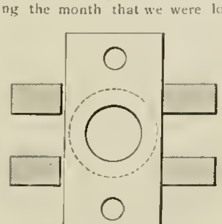


Fig. 4.

crucify ; but as the writers signed simply "E. C. Centric," "Subscriber," "Reader," "J. G. W.," etc., and did not also give their own names and addresses, they had to go. Your own name is not necessarily required for publication or to forge bank checks to, but we insist on 'em in self-defense, in case of breach of promise, and to show that you really mean it.

Air Brake Practice.

BY J. F. PHELAN

First Paper.

In dealing with air brake practice, we need not know how to build or rebuild an air pump, an engineer's brake valve or the triple valve, or other parts. It is always desirable to know as much as possible of the construction and workings of all parts. It is mainly desirable to know the principle on which air acts in doing its work, to insure good practice. For an individual to attempt to explain the intricate workings of the triple valve on all occasions, or by cuts or figures, leads to confusion in the inexperienced mind. Let it be understood, however, that within the triple valve lies the principle of automatic air brake action, and the student who wishes to understand it thoroughly must witness air brake repairs or get at a triple valve with sections cut out so as to display the mechanism in action. At all division terminals of railroads such sectional views should be on hand for study and practice.

Up to the present time it has been a difficult matter to get down to definite rules in governing air brake appliances. For the future, until the new Westinghouse triple valve and latest improved automatic brake appliances come into general use, there will be more or less distinction and varying opinions concerning straight air and automatic air practice. With the new equipment in use, straight air will be doomed, and then definite rules will have force, only limited by the condition or state of repair of the brake appliances in use, and the intelligence of the individual handling the same.

There is a general desire to learn more of the workings of air brakes, and the future will develop a general knowledge beneficial to all concerned.

To begin with, there is always an air pump, or small engine in itself attached to an air pump. The small engine, composed of steam valves and piston within a cylinder, worked from steam connection with locomotive boiler, is for the purpose of working another piston and set of air valves within a cylinder in connection with steam cylinder, common terms of expression being steam cylinder and air cylinder of air pump. The steam piston, working the air piston, draws air from the atmosphere, and forces it into a fair-sized air reservoir located at some convenient point about the locomotive, where the air is stored, and from there distributed to auxiliary reservoirs, or brake cylinders, as may appear further on.

The volume of air stored in this way depends on the size of the main air reservoir. The pressure per square inch thus stored, as indicated by good judgment and practice, should not exceed 90 to 100 lbs. in reservoir, and but 70 to 80 lbs. working pressure in train pipes and auxiliary reservoirs, located under tank and each car.

From the main air reservoir, a pipe leads to the engineer's brake valve, located in the cab, convenient to engineer, to use in handling the brakes. From the engineer's valve, a pipe leads back under tank and all cars on which air brakes are used. Under tank and each car, this pipe is connected with an auxiliary air reservoir and brake cylinder, through the medium of a triple valve, wherein lies the principle of automatic work.

The auxiliary reservoir is for air storage, supplied from main air reservoir on engine. This auxiliary reservoir, at all times when brakes are in working order, contains a supply of air pressure, to act on piston in brake cylinder to apply brakes, when action of triple valve is prompted by reduction of air pressure in main air pipe, by action of engineer releasing it through engineer's brake valve, or from any other cause, such as hose parting, air pipe breaking or springing bad leak, or any similar cause. To state the matter in plain English, reduction of pressure in main air pipe causes triple valve to move down, and opens a passage for air to flow from auxiliary reservoir to brake cylinder. In the new triple valve this reduction of pressure causes air to flow from main air pipe into brake cylinder, until pressure is equalized in both, when the brake cylinder receives supply from auxiliary reservoir also. It is needless to say that air going into brake cylinder sets the brake.

In the original Westinghouse system, straight air, there was no triple valve or auxiliary reservoir under cars. There was simply a brake cylinder connected with main air pipe. To apply brakes, air passed from main air reservoir on engine, through engineer's valve, back through main air pipe, flowing into brake cylinders and applying brakes. When stop had been made and engineer's valve been changed by engineer, the air returned through same pipe, escaping to atmosphere through an opening in engineer's valve. Originally for this service, the engineer's valve was a simple 3-way cock, and the same is yet in use for straight air and automatic on some roads. This 3-way cock might be termed a sort of improved beer faucet set at junction of two pipes, with a third opening for exhausting air, when contents of pipes were to be emptied into atmosphere. Its main function being to keep air supply in main reservoir from escaping, until wishing to use the supply in setting brakes, handle and plug would be turned to allow air to flow from main reservoir to main air pipe and brake cylinders. Returning handle and plug to regular position, supply would be confined to reservoir again, and that in main pipe and cylinders allowed to flow back and out into atmosphere, thus releasing brakes. Using the same 3-way cock for automatic air, its function would be changed, and in regular position would keep supply of air in main air reservoir in constant communication with main pipe and auxiliary reservoirs. Turning it around to correspond with releasing brakes in straight air, would simply shut off supply flowing from main reservoir to auxiliaries, and allowing that in train pipes to escape, start the triple valves and allow supply from auxiliaries to flow into brake cylinders. Throwing it back again to allow air supply to flow from main reservoir to main air pipe, would release brakes by action of triple valve, and recharge auxiliaries, the quantity having been used in brake cylinders, in setting brakes, being allowed by action of triple valve to pass out into atmosphere directly from each cylinder.

Too Much, Indeed.

In speaking of the examination of new men by the "Q.," the *Railway Master Mechanic* says that the question:

"What course would you take in order to run into station if both front cylinder heads were blown out? was too much for most of them. The proper method would be to remove the steam chest covers, block up the front ports with wood, and, after replacing the covers, go on as usual."

The circumstance is a very unlikely one in the first place, and the answer a misleading one. The taking off of both steam chest covers, and the work of nicely blocking both front steam ports, is the work of more than one hour. Tools to make the fit a good one are not furnished, the port is small at the seat and larger and irregular, half an inch below it, and it would be almost if not entirely impossible to fit a block in it, keeping it away from the valve, so tight that it would not be blown out. An attempt to do this, in practice, would delay not only the engine crippled, but many other trains beside. The engineer who did it would also run great chances of further damage by the blocking working out and catching the valve.

This is one of those railroad problems that is often done in an office and on paper, but when it comes to doing it on the road any engineer who attempts it runs a chance of doing the road more damage than there is any call for, and would be reprimanded or punished by almost any master mechanic in the country. If you find yourself with both front cylinder heads out, protect your train, send for assistance, disconnect your engine, get out of the way as quickly as possible, and be "towed in." The idea that there is a disgrace about being towed in, when you can't help it, without delays to trains, and taking uncalled-for chances of heavy expense to your company, is all humbug.

The spectacle of a locomotive with both front heads out proceeding with her train *as usual* is one of the things we would like to see. A locomotive in this condition would be much more helpless than a locomotive "on one side."

Double Fire Doors.

Double fire doors, some that slide to each side, English style, and others that open each way from the center, are being adopted on a great many Eastern roads. They occupy less room, and there is no good reason why they should not be better than the old swing doors that are noted for their habits of "not staying put" in any position but shut.

Correspondence

That Air Pump Conundrum.

Editor The Locomotive Engineer

In reply to W. F. R., in your April number, I want to say that if W. F. R. had looked in the air cylinder instead of the steam end, he would have found his terrible pounding. If he found the steam end just as he says he did, I think that one of the air valves had got corroded fast, and the pump was only pumping air on the down stroke. F. M.

Greenbush, N. Y.

Gun Barrel Boilers.

Editor The Locomotive Engineer

One of your correspondents speaks of gun barrel boilers, and the remark pleased me, as I am sighting over an old smooth bore boiler of 12 gauge. This small boiler has her gauge cocks within 8" of the top of shell, and I think here is the main trouble; the boiler has a large fire box and enough flues for a larger shell, but there is no place for the steam, as the dome is very small.

One of these engines recently went into the shop and got a new fire box and a new dome, much larger and higher than the old one, and it helped her wonderfully in carrying her water and in steaming. I don't think locomotive boilers, as a rule, have large enough domes.

St. Louis, Mo. JOHN VERDER.

Wants That Air Pump Cigar.

Editor The Locomotive Engineer:

In answer to Air Pump Conundrums, by W. F. R., in your April issue, I think he has set the ball rolling in the right direction. I have not worked much on air pump repairs, but have studied it a little with what spare time I have at my disposal, so do not consider myself a very competent person to answer the many little mysteries concerning same

I can only answer for the pump working as described on account of the top exhaust port of steam cylinder getting foul, or partially stopped up, and not allowing the steam to get away properly, thus creating back pressure on piston, and consequently making piston to return quickly on down stroke. I trust if this is not correct W. F. R. will kindly tell us what he did find.

I think your paper the best of its kind I have ever read.

Schreiber, Ont. T. J.

Retarding Power of Brakes.

Editor The Locomotive Engineer:

In your March issue, under heading of "In the Roundhouse and Repair Shop," you say that the simple widening of driving brake shoes, grooved to cover flange of wheel, has increased the retarding power of driver brakes and lessened the wear of tire. I agree with you so far as the lessening the wear of tire, but not in increasing the retarding power. The bearing surface of the shoe is widened 1½" to cover flange, and is grooved 2" wide to prevent it wearing where tire comes in contact with the rail. The shoe only bears out parts of tire that do not come in contact with rail, thereby keeping tire worn almost as true as when turned, but reducing surface of brake shoe 12 square inches. This I do not think affects the retarding power of brake. The power of any brake is in the power that forces the shoe against the wheel, and not in the shoe or rubbing surface exposed. The above are my views of the matter; if I am wrong am willing to be convinced.

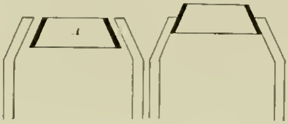
Allegheny, Pa. JNO. HOWARD.

[In the main our correspondent is right; the retarding power of a brake is the power applied to the shoe, and the distance from outside of tire to center of wheel. In the case we noted the engineers had told us the new shoes held better; we believed them then and believe them yet. The principal braking is done on the flange, which gives more leverage, and the wheel surface presented to the brake shoe is rougher than the tread, giving more friction.]

The Variable Exhaust.

Editor The Locomotive Engineer

In your issue of April you speak of exhaust nozzles that can be regulated by a rod from the cab, and also mention the use of a plug in the nozzle. That is a very simple arrangement, but I think a nozzle like the one here shown is a little better, as there is practically nothing in the path



of the escaping steam. The tip *A* is raised up or let down, according to circumstances.

2156 Second Ave., N. Y. F. HOCHBRUNN.

Care of Locomotive Jacks.

Editor The Locomotive Engineer.

I am a fireman, and throw black diamonds at a hole in a Baldwin consolidation that belongs to a road whose master mechanic holds the fireman responsible for care of jacks, frogs, switch chains, pinch bars, etc.; in fact, all the tools in the big tank box. Just why I am expected to clean and look after these things every two weeks is not yet clear to me.

We carry a little of everything in our back box, hemp packing, stack paint, old oil can, extra air hose, old pair of overalls, extra brass for tender-box, a few pails of cinders, some wool waste to pack boxes, extra scoop and shake lever, an old lantern frame, and a general assortment of extra spring hangers, bolts, nuts, spring keys and rusty nails. My engineer says all of these are handy.

I found that with this collection it was next to impossible to get anything to lay still, and the way they dance and rub and tangle up is a caution. If I oiled the screws to our big jacks the oil collected dust till it was a paste; then, when we wanted to use them, they wouldn't come up. I took the screws clear out and wrapped them in oily waste and an old pair of overalls, and I thought I had them pat. I looked at them once a week for a month, till one day we wanted to use them, when I found that a big hook on the switch chain had worn a hole through the armor of one, and made a mark on the thread big enough to prevent us from getting the screw into the base; then I went and had a piece of ½ inch board turned up just the right size to fit the circular hole in the bottom of base piece I painted the edge of this with white lead, and, after pouring in about a pint of black oil and coal oil, I forced the wood into the hole; the oil soaked the wood up and made it tight, and I have had no more trouble; the oil can't get out altogether, and the dust and cinders and water and rust can't get in. I oil them about once a month or six weeks, and keep the screws down. It is a little trouble to fix up, but it pays. SCOOP.

Sedalia, Mo.

Coal Records.

Editor The Locomotive Engineer

I was pleased with your article on coal records, more especially as I had just had a little odd experience in that line At the terminal station, the coal chute fiend has been kicking for bigger checks—and got them. The other day, at a chute out on the road, I took 100 bushels of coal, and the chute man said: "Never mind the check, I am 2,600 bushels ahead of the cars this month."

The boys must have been liberal with checks, or more likely the *guesswork* had been poor: this man had checks for 2,600 bushels more coal than he had received. If managers are as careful (?) with their ticket receipts as they are with coal it is no wonder that some of our roads are in the hands of receivers, and English locomotives posing as the most economical coal consumers on earth. The enginemen of this country are more anxious to show economical results than their officers are anxious to have them shown.

Denver, Col. H D. DOYLE.

Oiling Driving Boxes.

Editor The Locomotive Engineer.

Any runner who has watched his engine carefully and has had any experience at all, has had hot driving boxes, and tried to think of some way to help the matter.

Some engines are built that have such small driving box bearing that they are continually hot. In cases of this kind about all the engineer can do is to oil, pack, experiment and swear.

Some engines are built that have babbitted boxes, and when one of these gets hot enough to melt the babbitt there are no more oil holes, comfort or safety.

Some engines are built that have little or no packing space in the cellar, and no matter how well proportioned, are chronically hot.

Before now I have had hot boxes caused by the top oil holes being stopped up, and always found that if I could take out the inside cellar bolt and tip the cellar in enough to put in some fresh waste, and oil there by reaching across from opposite side of engine with a long-spouted can, they cooled off. This led me to think; thinking led me to an experiment.

I was coming in one day on the "Hummer" (humming along about fifteen miles per hour, with one car more than a train and a Dutch clock), when the fireman said: "John, there's a hot hub over here"

I was tired—born so—but I slid off the seat and went over to his side; something did smell hot; I looked back at the tank boxes, and there was ice on them; there was a box smoking on the second car, however, and I turned to that smutty-faced youth with a visage wrapped in stern reproval, yet a heart full of fatherly love. I am not a man of words, but of actions, and I took that student of smoke by the ear and led him to the gangway and pointed back to that hot box, that wasn't mine, with the same kind of a look upon my classic features as must have sat on the phiz of Sir Isaac Newton when he discovered that apples fall down instead of up. I resumed my vacant seat with a sigh, and hooked the finger beam down a notch when the boy wasn't looking, just to get even with him for causing me extra exertion.

At the next water tank you could cook steak on the left forward driving box of our old mogul, and I compromised with the smoke shoveler by giving him the last and only cigar I had

The oil hole was stopped up and I couldn't unstop it, and I did not waste much time trying; I let down the cellar on the inside, put in some clean waste, a lot of cold tallow, and went on. The box cooled off—so did I.

The next day was my lay-over, and I took that cellar out and had a hole tapped into one corner on back side and threaded for ½ inch pipe, and an elbow put in; then I had a piece of 1-16 iron cut to go into bottom of cellar, a loose fit; it also had several ¼ inch holes in it, and a flat brass spring under it; this was to keep the wool up against the journal always.

I put this up well packed, and screwed into the elbow a piece of pipe just long enough to come above top of driving box; then I made pine plugs and stopped up top oil holes for sure. I ran that engine until she was condemned, and that box never got a drop of oil from the top holes; it was never hot, and it was never petted; I packed its cellar only when I packed the others.

I believe that if driving boxes had no holes on top, but had a long drill hole through box to each side of cellar, and the cellar arranged to keep its packing in constant contact with the journals, that we would have fewer hot driving boxes.

JOHN ALEXANDER.

Early Experience with Balanced Valves.

Editor The Locomotive Engineer

In reading over the April number of THE LOCOMOTIVE ENGINEER I ran across a little item about the extended use of balanced valves. About thirty years ago I ran an engine that had a balanced valve—or rather what they called balanced. The valve itself was planed off on top, and scraped to fit a plate fastened to the cover; there was no springs, packing strips or rings at all. I started out one cold day with the engine and a train of railroad officials, also the inventor of the balanced valve. The engine worked nicely, and after a few hours' run we stopped for breakfast. I left the engine on the train, the reverse lever in the center notch, and struck for the dining-room.

It was fully thirty minutes before the party were ready, and after oiling around I got a signal to go—but I didn't. It was a very cold morning and the frost king had got in his work. I could not get the reverse lever out of the center, and the longer I waited the larger the crowd got around the engine; it was full ten minutes before the "balanced" engine got away, and then only after a vigorous warming *via* the throttle.

When we got to the shop the balance plate was raised, and after that I could see no advantage over the old D valve. I suppose the contraction of the sides of chest and the studs came down enough to pinch the nicely-adjusted valve. I remember the clown fireman remarked that the valve had swelled—if it did steam unswelled it.

ELMIRA.

Elmira, N. Y.

The Fixed-Nozzle Injector.

Editor The Locomotive Engineer

In Forney's Catechism of the Locomotive, page 123 (1881), questions 136 and 137 are answered in a way to muddle younger students of the injector. I see Mr. Forney has not changed these answers in his revision of that work now appearing in his paper. That I may not be misunderstood, I repeat the questions and their answers.

"*Q. Will a 'fixed-nozzle' injector, such as has been described, answer as a boiler feeder on locomotives?*

"*Answer.* It will answer at some one pressure of steam, to which pressure it may have been adapted in making the instrument, and at that pressure it will work admirably; but it will not work satisfactorily at any other pressure, either higher or lower, and has not much range in quantity of water delivered.

"*Q. What is required to make an injector work at different pressures?*

"*Answer.* The instrument must be so made that the water passage between the receiving tube and the combining tube can be varied in size. This is usually done by making the combining and receiving tubes conical and moving the former to or from the latter, thus contracting or enlarging the water space. Such adjustment must be made at each change of steam pressure in the boiler."

Now when it comes right down to a matter of theory I am not there; my life has been spent on a locomotive in practice; I know from actual personal practice that a fixed-nozzle injector will work very satisfactorily on a locomotive with all the different steam pressures that we are ordinarily called upon to use, and that without hand adjustment. I have run a heavy ten-wheeled engine with fixed-nozzle, non-lifting injectors alone, and have supplied the engine when pulling a very light train or a very heavy one, by simply adjusting the lazy cock and steam throttle. I have also done the same with a Monitor and a Hancock Inspirator, both fixed-nozzle instruments. This proves to me that this class of instruments have a great "range."

The load to be moved, not the steam pressure, determines the amount of water needed. Injectors of every class have to control this by the amount of water supplied to the instrument, but not necessarily by moving the combining tube.

If this is not "range," the practical men on the road do not understand the term. I can start my Monitor No. 7 with 40 pounds of steam, and, leaving the lazy cock in the same spot, it will start again and work at 150 pounds' pressure by opening the steam valve the same as at 40 pounds. It will just supply the engine running 30 miles per hour with a heavy train; I can adjust it to just supply, when running a light train 15 miles per hour. If this is not range, and adaptability to all practical purposes on a locomotive, what is? To be sure there is some difference in the amount of water delivered at 40 and 150 pounds' pressure, but this amount can be regulated by the water and steam supply cocks. This supply does not change as much as one would suppose. Again, if a locomotive "goes back" on her steam 20 to 30 pounds, any runner will shut off his water supply to let her catch up if he can. The way we are loaded now don't admit a variation of more than 20 pounds. It seems to me wrong to tell young firemen, or engineers either, for that matter, that a certain thing *must* be so; for instance, that an injector must be made so that the water passage between the receiving tube and the combining tube can be varied in size to make the instrument work at different pressures, when their daily task is in doing the work successfully in entirely a different way. They are either mystified about the operation of the practical things in their own hands, or begin to doubt the soundness of the theories laid down by eminent writers in their line.

I know that our Sellers and Giant injectors, that regulate by moving one of the tubes, break very easily when trying to throw a very small amount of water, and the latter can be regulated finer by using a lazy cock than by using the adjustable tube.

I am not arguing for or against any particular kind of injector—I can use any of them and get all the water I want—I am only arguing against trying to teach men that a fixed-nozzle injector will not do what they are seeing it do on a thousand different locomotives every day.

Engineers and firemen are just commencing to study and read, and are hunting high and low for correct information. If Mr. Forney does not mean to convey the idea just as I have stated it, he should change the language, as it is so understood by all the engineers and firemen of my acquaintance.

Kansas City, Mo. JOHN REYNOLDS.

Poor Tank Brakes.

Editor The Locomotive Engineer:

What engineman is there who has not at some time tried to set the tender brake, and when most needed the thing wouldn't work?

If in winter time the staff gets frozen into tank deck, ratchet and pawl are covered with coal and cinders, and if it should be summer, instead of the staff being frozen it often gets so tight it can scarcely be moved, on account of deck being water soaked.

Now this can easily be remedied, and it is surprising to us that it has not been done.

Some builders still put brake on left side of tank, where the fireman can bark his knuckles when not otherwise engaged. The right side is the place for it—handy for the engineer to use, so as not to trouble his partner.

In place of having the ordinary bracket to hold top of staff have a plate instead, and made wide enough to hold pawl and a light spring to keep the pawl against ratchet wheel. Then have a piece of gas pipe, large enough for staff to pass through, bolted or riveted to the plate and running down through tank deck. This would always keep the staff free. The ratchet being on top of tank instead of at deck, it would never be covered with dirt or coal, and having the pawl held against ratchet by the spring, the brake would always be in working order unless some of the parts under the tank were "out of kilter" Many roads use air or steam brakes on the tenders, but these sometimes fail, and a good, reliable hand brake, always ready for use, is a handy thing to have around.

Denver, Col. H. S. H

Railroad Promotions.

Editor The Locomotive Engineer:

In my exceptions to the article on the "Coming Man," the point of argument is misunderstood. I take no exceptions to the class of men that are promoted to engineers. In regard to machinists runners, I brought that up for this reason. How can an engineer get shop experience on the road, any more than a shop man can get road experience in the shop. Can't a first class locomotive machinist (qualifications being equal) get road experience just as soon as an engineer can get shop experience? Don't you know any engineer that never fired a locomotive? I do. I can send you the names of four in the employ of our road. One is M. M., another is foreman of the machine shop. Had shop experience for 15 years before he ran. The other two got $3.60 and $4.50 per day, while they were getting *their* road experience. There are but few shop men that would go on the road, that would make good runners. All firemen don't make runners. But I *do* think that shop experience, after a man has fired a reasonable length of time, makes the man a better runner. Another reason that machinists are not promoted is this: when they find him to be a first class shop man, they feel that they need him there, more than on the road.

Now, Mr. Editor, just give the poor machinist a fair shake and I will not argue machinist runner any further, for it is not my point. The point that I object to is this. From the tone of your article on the "Coming Man," you seem to think that there are no class of railroad men that are competent to be superintendents, M. M, or foremen, except engineers. This is the point that I take exceptions to. Now, you claim that you have had shop experience, don't you know of any man (with shop experience only) that you would trust to take charge of a railroad shop, if he had served 10 to 15 years in that shop? Suppose he knows where all tools are. Has run shop. Knows the system of the shop (if there be one). Knows what men do their work well, and what men slight their work, or what men will kill time on a job. Isn't he just as competent to take charge as the engineer with road experience only? This is the point that I argue; and whenever there is a vacancy in a shop, if there is a machinist with the qualifications he should be promoted in preference to an engineer. It is a job that a shop man feels that he has a right to. Qualifications being equal, a machinist has just as much right to rise in the railroad world as any other class of men.

Your paper is for all men connected with the machinery department of a railroad; don't boom one class, but give us all a show. I don't deny the influence of engineers in regard to supplies or improvements, but I do deny that they are the only class of railroad men that have the qualifications for any promotion. Machinists make just as good M. M.'s or foremen as engineers. Road foremen, traveling engineers and superintendents are another class of railroad men, and out of scope of shop or roundhouse service. C. W. L.

Columbus, O.

[We agree that a shop man can get road experience as soon as a road man can get shop experience—road men, as a rule, do not desire the shop experience, they do not want to be machinists. We do know men who are running who never fired. Men used to run, years ago, who came from the shop; conditions have changed; men cannot learn the duties of the road now in a few months; it takes years. Machine shops should be under the foremanship of machinists certainly; roundhouses can be easily placed under a machinist or a runner—either will be poor enough to suit the engineers and the roundhouse men too.

No one disputes the fact that any employe has a right to rise in the world. Superintendents and master mechanics are all the better fitted to fulfill their duties, if they have road experience. Machinists certainly should be promoted to positions they are better qualified to fill than engineers, and *vice versa* We know successful M. Ms. who never ran an engine a mile; we know others who never worked a day in a shop.

The point made in the article on the "Coming Man," was, that the engineers were the men who tried and decided on the merits of any device on a locomotive —and they are. That so many engineers have been promoted to high positions of late years, has shown only that their knowledge of road service made them valuable men for the business of the company—pulling cars over the road.]

Pittsburgh Locomotive Works test their boilers with steam up to 225 pounds.

An Invention Wanted.

Editor The Locomotive Engineer.

Why is it absolutely necessary that the sight feeds on cylinder lubricators should be within an inch of the cup itself? They used to go outside to pour tallow into the chests, but they soon found they could pour it from the cab just as well by using a pipe.

Now there are a great many sight-feed lubricators on the cab end of those oil pipes, but the "sight" is right next to the cup, and this is often placed where the engineer can't see it very well in the daytime, and not at all at night.

It seems to me that some inventor ought to get up a scheme that would let the "drip" and the glass be located any place in the oil pipe; this would allow the two glasses to be brought between the engine and the gauge lamp, and the cup could be located any place out of the way. If some more fortunate brother will tell me how to keep my headlight from smoking, so I will not have to clean it every trip, I'll invent the rig myself.

Minneapolis, Minn. "Soo."

Modern Improvements.

Several instances are on record where railroad men have recovered damages for being crippled on account of the company's refusal or neglect to furnish improved appliances of one kind or another. Some of the towns in Minnesota, Dakota, and other Northwestern territories are suffering from the same cause. Many of these towns voted bonds to get the roads there, and the roads were glad to get the bonds and all the stock and grain they could haul in the fall, but when the snows were deep this winter they did not make an effort to relieve the suffering caused by being isolated from the world, short of fuel, no mail, and no chance to buy or sell. If the town was on a branch, all the worse for the town.

In some places up there when the snow plow did reach town there was a regular jollification parade.

Mechanical devices for clearing snow from railroad tracks are now very reliable, and there is no possible excuse for any company under any circumstance to leave any town on its route shut up for weeks at a time.

All Are Not Alike.

On some roads where there are in use for years one certain kind of engine, the men become so used to the handling of them that another make, equally as good, is condemned as radically wrong on first trial. We remember one instance where the new make of engine were condemned for slipping, and the engineers kicked till they got bigger sand boxes put on them. A year after, the engines slipped no worse than the rest. The trouble was that the new throttles were wide open by an inch movement of the stem, while the old ones only opened about ⅜ of an inch for the same movement.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS.

The Hospital Steal.

There are many roads that have a hospital and a doctor corps. That regular, sworn in, company surgeons are very handy things to have (for the company) in case of wreck, there is little doubt; dead men are only worth $5,000, while cripples come higher. When it comes to letting the doctoring of the employes of a whole railroad out in yearly contracts, God pity the sick.

Investigation will show that half the roads, where a hospital system is in force, have fine hospital buildings and a lot of salaried surgeons to use in case of accident, supported entirely by taxes on their men.

It is the general custom to assess each and every employe of the company 50 cents per month for the hospital fund: this is $6 per year for every man, and calls for many thousands of dollars every year.

A man may pay his regular monthly tax for years, and if he leaves the employ of the company or is discharged he gets not one cent.

He may be discharged from the service of the company and cut off from hospital benefits because he is about dead with consumption, cancer, or some other lingering disease, after paying assessments for years.

We know of several cases that have come under our own observation that will tend to show some of the evils of this illegitimate tax.

The senior surgeon of a big road was called to a freight train wreck, and assisted the local surgeon to amputate a leg for one of the unfortunate employes; there was another railroad man badly hurt, but he was not in the employ of that company; he was dead-heading over the road in search of work; the senior surgeon asked if he was a passenger, and when told who he was offered to amputate his limbs if he had money to pay for the service; he had not, and died. The employes petitioned the management for a change of physicians, but the brutal senior was a fixture.

In another city the regular appointed doctor was so disliked, and was so careless of his duty, that all the employes of the company at that place signed a petition asking for his removal—but were informed that he had been appointed for a year, and he stayed.

Under such circumstances men will employ their own doctors and buy their own medicines.

If a man will go to a hospital in case of serious sickness he is entitled to his board, attendance and medicine, but men who have homes will not go to hospitals.

Men who have paid for years for medical attendance that they have not needed, are obliged to use one kind of medicine when they have faith in another, or hire their own doctor. This they do, and the company want them to do it. We know of one railroad hospital, built from this drain upon labor, at an expense of many thousands of dollars, that had, on its opening, a big "housewarming," a supper and a ball. The mayor of the city made a speech, the manager of the railroad danced in the head set, and the morning papers told how the great and good railroad was *caring for its men.* Not one employe of that company, except officials, was asked to tread a measure or partake of one mouthful of that feast, or look upon the walls of that magnificent building that the company had built *for them*—and made them pay for.

When there is a great wreck these hospitals are filled with dead and maimed, and the working men on that road pay for it—not the company.

A single man without means is taken sick or is hurt, and receives treatment in the hospital; you say this is good work. The company could afford to have him treated at a pay hospital, or the men would do it voluntarily.

Engineers, firemen, conductors, brakemen, mechanics, section men and laborers are all human beings—to the contrary notwithstanding. This is a free country, and no man, be his pay $10,000 or $10 per month, wants any guardian placed over him. He wants and has a right to expect pay for all his work. He wants to employ his own doctor, butcher and grocer, and pay them himself. He don't want to pay for service he does not receive. He don't want to insure his employer—the company—against loss if anything happens.

It would seem to be a fair scheme if the railroad company would put in every month as much money as all the men did. This would not be the snap it is now; still, it would be wrong.

Where men are obliged to pay for service, why would it not be nearer square if the men elected their own doctor and their own druggist? Railroad men have good and efficient beneficiaries and insurance in their brotherhoods and unions, and assess themselves heavily for mutual benefit. To assess them for the benefit of a hospital grab is taxation without representation. It is demanding something for nothing. It is extortion. It is robbery.

Unfair Treatment.

There is and always has been a constant demand from the management and transportation departments of all the railroads of the country for better locomotives and more economical service. They have always wanted more and heavier cars hauled at higher rates of speed than in the past or was hauled by rival roads. They expect all this to be done with less fuel, less stores and less repairs than the old engines received or needed. They want men to run and fire the engines at less pay, for longer hours or more miles than is safe.

The management lets the head of the mechanical department order or build a locomotive that it is hoped will eclipse all others, and in many cases if it does not do all and more than is hoped for, the master mechanic is often asked to resign, to give some other man a chance.

These very managers are very backward about granting passes to master mechanics to attend the yearly meetings of the American Master Mechanics' Association to exchange notes and bits of experience. These discussions are productive of much good, and have saved many an M. M. from experimenting on ground already found barren. The entire object and aim of the association is to make its members better posted mechanics, and the good results from these meetings can finally come to no other place than to the profit of the companies the men serve.

It is high time that the general practice of laying all the wrecks, failures and delays in practical railroading to the motive power department was stopped.

It will pay any railroad company to be a little liberal with the officers and men in its machinery department. Give them chances to discuss vital questions with others in the same walk in life. Let the master mechanics and the engineers go around a little and study up.

A little liberality in the pass business, and the retiring of the system of docking the master mechanics for time lost in attendance at these association meetings might result in considerable good to the roads.

When all roads are under the management of men who have seen service in the ranks, we will have better managed roads, better engines, better service and more contented men.

Bridge Accidents.

There has been considerable printer's ink used in the last month trying to explain how trestles and bridges are neglected till they let trains fall through them, on one hand, and how no amount of care will prevent trains from jumping the track just at a bridge, on the other.

One man, perhaps over zealous, or even malicious, wrote an article for the New York *World*, just after the fearful accident at Blackshear, Ga., making some very damaging statements about the condition of bridges on the Savannah, Florida & Western Railway, where the accident happened. Since the appearance of this article, H. S. Haines, general manager of the above company, has published a long communication in several papers, giving the details of the mode of inspection of bridges on his road, which, if true, is as complete and careful as can well be devised. An ex-civil engineer of the road now publishes a letter verifying the manager's statements, and showing more fully the system of examination. In speaking of the accident he says:

"*First and foremost, no trestle or bridge ever built could withstand the tremendous strain put on that at Hurricane Creek, be that trestle or bridge wood, stone or iron.* Private dispatches received by parties in this city state that the baggage car was next to the locomotive. The front axle, or one of the journals of the front truck under that car broke. The truck was slewed around directly across the track, dropping down on the cross-ties. The weight of the train behind that baggage car was 240 tons, driven with a momentum of 45 miles per hour. With this condition of facts there was but one of two things which could happen, namely, either the 'immovable mass should succumb to the irresistible body' or vice versa; or, in other words, either the train should reduce itself to kindling wood and remain on top of the trestle, or else the trestle must succumb to the momentum of the train and go down with it."

If the first statement is correct, there would seem to be no use in building a bridge stronger than was just necessary to sustain the weight of trains. That bridges have been built that sustain shocks similar to those mentioned by the above writer is well known.

Wooden bridges have stood up under truckless cars at great speed, not, perhaps, so much on account of the strength of materials used, as upon the safety appliances of the bridge. Guard rails placed outside the tracks, also between the rails, keep "slewed" trucks from getting a hold, and allow any sort of wreckage to slide over, instead of being sure to find a butting post and a trap-door at the first bridge. Stone arches are generally covered with earth or stone ballast, and a wreck on them would be the same as on the ground anywhere.

As to the condition of this particular bridge, or any on this line of road, we know nothing; we do know that trestle work is, as a rule, weak for the work it does.

We should think the right thing to do would be to either make the "immovable mass" (the bridge) strong enough to stand up under broken axles or derailed trains—the general excuse given for bridge accidents—or make some provision to prevent the cars from "jumping the track" just at the bridge—or slide them over when they do jump.

Accident reports are showing all too often how trains running at even more than 45 miles per hour have been suddenly checked, as in case of collision, without all of them being "reduced to kindling."

Brake Improvement Needed.

Locomotives on some roads of the United States wear out more brake shoes on freight cars when the brake is supposed to be off than as many locomotives of England do when they are on—another side light on the difference in coal records.

In this country we have much heavier grades, use more power brakes, and keep them up better. On our grades, especially where continuous power brakes are used, it is desirable to have the brake work with as little slack as possible, and means are provided to take up this slack, generally located under the car. Our brakes are, as a rule, hung from the body of the car and the shoes grip the wheel well below the center; this keeps the brake beams from "climbing the wheel" and entangling the whole gear.

When the car is loaded down with from 30,000 to 50,000 pounds, the shoes are a considerable distance from the wheel, and, if the grade is heavy, the boys get under the car and take up the "dead lever" a hole, or screw up a nut, or any other means provided to take up slack. The brake works well, but when the car is unloaded the springs pull the body up and the shoes tighten on the wheel or are so close that the swinging of the car keeps a lot of cast-iron shoes in contact with the wheels. It costs money to pull cars under these circumstances. They may look all right and the brakemen swear brakes are all off, but, if you look back after night, you will see a torchlight procession following you.

Eight-wheeled cars, having brake beams hung as above mentioned, ought to have some easy means of taking up the slack, without going under the car. An easily moved lever under sills and in center of the car would fill the bill.

Master Mechanics' Association.

The twenty-first annual convention of this association will be held at Alexandria Bay, N. Y., June 19th. The place selected is in the world-famous Thousand Island country, June, one of the most enjoyable months, and the M. M.s an extraordinary lot of men. If in this selection of one of the finest Edens of nature, the virgin queen of months and the cream of railway brains, we get no new or good results, this talk of good company is all bosh.

ASKED & ANSWERED.

(22.) J. C. W., Pittsburgh, Pa., asks:

Do you think it possible that the corrugated fire boxes in the Strong locomotive boiler will expand by buckling in its corrugations. *A.* No.

(23.) Union Jack, Toronto, Can., asks:

Are there any locomotives in the United States that have brakes on the front truck wheels? *A.* Yes, a few; the Beals brake puts two shoes on every wheel under engine and tank.

(24.) Quiz, Como, Col., asks

How do you make a heater of Hancock Inspirator? *A.* Shut off valve in steam pipe, bring operating lever to position for working injector, and then apply amount of steam required to keep water in pipes and hose in motion.

(25.) R. A., Rutland, Vt., asks:

What would be the result if checks were tapped into steam space instead of below the water line, and has it ever been done? *A.* If it was near dome it might interfere with working dry steam; it has been done, some old engines had two domes, and the checks went into the forward one.

(26.) Car Repairer, Baltimore, asks:

I find in all the air brake cylinders I take down a slot about three inches long in the bottom of the bore of cylinder. I thought at first it was to hold oil, but it can't be that. Don't it leak air? and what is it for? *A.* The slot is to let a little air leak past the piston, to prevent the brakes from "creeping on" from some slight leak. When the brake is applied quickly the piston passes the slot and closes it.

(27.) Sub., Alexandria, Va., asks:

Do you think it possible for an engine to slip when running with steam shut off. *A.* If our correspondent wants to know if it is possible to *make* an engine slip when running with steam off, we would answer, yes; by reversing, the pistons will pump up air enough to slip the wheels backward or blow the chests off. If he wants to know if a locomotive is liable to slip under ordinary circumstances while running shut off we would answer no.

(28.) Boiler Maker, Weatherly, Pa., asks:

What is the "drifting test" for boiler plate, and how is it done? *A.* The drifting test is the practice of drilling a certain sized hole in the plate to be tested (usually a ⅝ hole) and then enlarging it with a taper drift till the metal breaks; metal that will stand an enlargement to double the size of hole without breaking is considered good. Different users demand different degrees of this test. The Northwestern Railway of Great Britain demand an enlargement to two inches. This test is used more in Europe than in this country.

(27.) Tenn, Knoxville, Tenn., asks:

Why could we not compound our ordinary locomotive by shutting off steam to one cylinder and piping exhaust from one to the other, using one side for high and the other for low pressure? *A.* Because the pressure on the piston of the low pressure cylinder can only equal the back pressure on the high pressure cylinder. In order to gain by two expansions of steam the low pressure cylinder must be much the largest

(28.) Blacksmith, Chicago, writes:

In our shop we have a large blower and an independent steam plant to run it, by recent additions to the shop we needed more wind, and belted up to run the blower just twice as fast as before. We expected this would double our coal consumption under boiler, but were not prepared for the results that followed—burning over four times as much coal What is the matter? *A.* You are now moving twice the *amount* of air you formerly were, and at twice the *velocity*. You are doing four times the amount of work The coal consumption is about what should be expected.

(29.) S. H., Quebec, Canada, writes.

I am a boiler maker in the C. P. R. shops, Quebec, and we have some Portland engines on this end of the road, and I find the third row of stay bolts up from the foundation ring drilled through with a ¼-inch drill. Will you or some of your readers please explain the object of this, and the object of copper rings on fire box end of tubes? *A.* On many locomotives in the United States one or two rows of stay bolts are drilled to admit air over the fire, to aid combustion, though the size is generally not over ¼ inch. Copper rings are put on fire box end of tubes to keep them from leaking it is very seldom done, late years.

(30.) Stoker, McCook Neb., asks:

What makes the clicking noise in steam chest or cylinders when the throttle is closed and the reverse lever not hooked down, and why does it stop when lever is hooked down? *A.* The clicking is caused by the valve being raised off the seat at each end of the stroke, when the reverse lever is left near the center the end of the valve covers the port about eight inches before the piston reaches the end of the cylinder, and the compression of air there raises the valve off its seat before the inside of valve opens the exhaust port. When the lever is at full stroke the exhaust port opens before enough compression to raise the valve takes place.

IN THE ROUNDHOUSE AND REPAIR SHOP.

The bill providing for the licensing of engineers and conductors failed to become a law.

* * *

The Londonderry Railway of Ireland is equipping two engines and a train with air brakes.

* * *

Correspondents must let us know their own name and address if their articles are expected to be used.

* * *

We wish some one would get out that cheap valve gear model we spoke of a month or two ago and put it on the market. We have had letters about it from everywhere and Arkansas.

* * *

William W. Hills, of Cadalac, Mich., has been granted a patent on the old idea of a valve in the spout of a long oiler. The device, to all intents and purposes, just as shown in the patent office reports, has been in use for at least twenty years.

Since the Old Colony has got hold of the Boston and Providence road they are repairing the engines, substituting numbers for names and straight-shot stacks for the diamond breed.

* * *

Superintendent Wightman, of the Pittsburgh Locomotive Works, has adopted the single admission port for steam chests. It does away with extra space at ends of chest, and admits steam at the arch end of valve seat. No doubt the proper place.

* * *

There seems to be a tendency on the part of many State legislatures to pass laws compelling railroads to adopt some form of continuous brakes and automatic couplers, to be in use after a certain date, generally about 1890. Let them come soon.

* * *

In this issue will be found the first of a series of papers on "Air Brake Practice," by J. E. Phelan, general road foreman of engines of the Northern Pacific. These papers promise to be the most complete, simple and practical instruction yet given on air brake practice.

* * *

Engineer Robert Patterson, Salida, Col., sends us the largest paid up club yet. Ninety-one names is not so easily picked up in a small place. W. H. Thomas, Superintendent of Motive Power, E. T. V. & G. Railway, Knoxville, Tenn., comes second, with sixty-four names.

* * *

A Wisconsin genius has got up a trunk that is not a trunk, but a cross between a chest and an express truck. This may make it a little easier for baggage masters, but what enginemen want is some sort of trunk that will let the conductor report a delay of five or ten minutes as time lost unloading baggage, instead of saying the engine did not steam.

* * *

Elijah McCoy, Detroit, Mich., has patented the idea of attaching lubricator pipes to the steam passages as well as to the chests The oil pipes on steam chests are used when running down hill and those on steam passages while using steam. It is claimed that oil pipes on chest are not effective where balanced valves are used, although we do not know why.

* * *

A fatal collision occurred on the "Q.," at Creston, Ia., on the 16th of the present month. The reason given was that the conductor had been on duty 54 hours, and fell asleep, thereby neglecting to take a siding. Before the strike the engineer would have been blamed for running by the siding—they must not be blamed for anything now. There should be a law against 54 hours' service or 24 either.

* * *

An Illinois inventor proposes a headlight in each end of passenger coaches, with their light reflected down the aisle. One reflector behind would no doubt let passengers read a little more than the murky glims now in use. But if an engineman was dead-heading over the road and went to sleep he would jump through a window when he woke up if a young headlight was shining in his face.

* * *

The general practice of the day seems to be to see how many flues can be crowded into a boiler. Recent orders in several shops place the distance apart at $\frac{5}{8}$ of an inch This is considered good practice where the number of flues does not exceed 150, but where there are over 200 2-inch flues crowded into a 60-inch shell the space is not enough. An old rule, and one that seems to bear out its correctness within the range of locomotive practice, is to allow $\frac{1}{8}$ of an inch space for every thirty flues Boilers whose flues are too close together are the ones that drop their water so bad when shut off, after working hard.

* * *

European railroad papers are publishing as "great improvements in railway carriages," an item stating that the Southeastern Railway of England are building "115 carriages with six-wheeled trucks, upholstered seats, lavatories and water coolers; they will also be heated." The poorest cars running in the United States have closets, ice water, etc.; our best roads have water in cars used to haul live stock. There would be a howl go up very quick if every passenger car was not heated just about right.

* * *

An English inventor has secured a patent in this country on the idea of extending the link slots past the blade connections. He uses this to open the port when the engine is "blind." An engine is called blind when she has no lead; that is, when on the center she will not open the port, if she has no lead ahead she generally has too much back, and it is customary in this country to slack back then go ahead when an engineer finds his engine in this condition; but he only stands it one trip. She is squared up at once. The best way out of the blind business is not to make engines blind. Eccentric blades have been connected to links almost everywhere, and that a man could patent a place to put them seems curious.

* * *

We are in debt to unknown friends in different cities of Illinois and Iowa for over a dozen papers, giving accounts of accidents on the Burlington road, also several pages of testimony before the Railway Commissioners of Illinois. Some of the new engineers (?) testifying that they did not know the signals in use, that the reverse lever lengthened and shortened the stroke, that they had been running without any examination at all until the morning of the investigation, and then had been told the answer to questions they could not answer, etc., etc. Some of the new men's own children testified that they had not been beastly sober since they could remember. These facts have been kept from the public by the meek and holy daily papers, with a telegraph franchise, who do not want to widen the breach between capital and labor (?)

* * *

At a certain station on a Western road there was a foolish boy always about the trains and engines. He invariably wanted to "run the old thing" a little ways. The enginemen were always hiring him to run or making a bargain to sell their jobs to him. One day there was a big crowd around, and he asked one of the men what he would take to get him a job running an engine. The engineer looked serious and said: "Now, no fooling, are you a real engineer?"

"You bet," said the embryo.

"Well, now, I'll tell you," said the plug puller, "down here at C—— there are over 40 steamboats tied up (C—— was on a sand bank, and not a decent drink of water in ten miles), you get right on here with me and I'll take you down there and get you a good job at $10 per day."

"No, I don't want any job, I can't run," said the big fellow; "I was on a steamboat once on the Missouri, and it takes a man to run one of them, but any darn fool can run a railroad engine. Why I've seen 'em go through here without anybody on 'em at all."

This boy has all the qualifications of a great general manager.

Human Sacrifices to Greed.

Thousands of young, able-bodied men are killed annually on the railroads of this country by the old hand brake and man-killer coupler, that could be saved by the application of automatic brakes and couplers to freight cars, and yet nothing is done to remedy the evil. If an equal number of horses or cattle were killed, a law would soon be passed to prevent further slaughter. If something is not done for the protection of these men, they will find means to compel the adoption of these safety appliances.

One hundred and sixteen brakemen were killed on the railroads of Michigan last year. If such an enormous number are killed in one State in a single year, what is the annual slaughter in the whole United States, and what shall be done with legislators who encourage this terrible butchery, by killing every measure presented for the safety of brakemen?—*Railroad Brakemen's Journal.*

There are now in use on American railroads 26,415 locomotives, 19,252 passenger cars, 6,325 baggage cars, 845,914 freight cars. The total cost of this rolling stock is $700,000,000. If made up in one train it would be 5,600 miles in length, or stretch twice across the continent.—*Express Gazette.*

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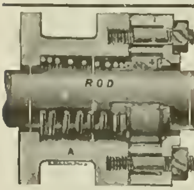

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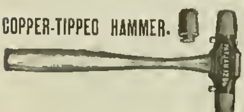

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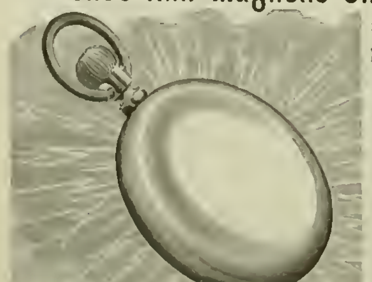

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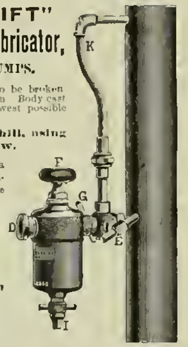

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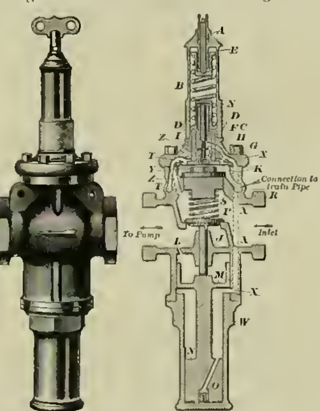
The Mason Air Pump Pressure Regulator.

The accompanying cuts represent the outside and sectional view of a pressure regulator designed by the Mason Regulator Co., of Boston, for automatically controlling the pumps used on air brake systems. It is well known by railroad engineers that a certain pressure (about 70 pounds) in the reservoir is most effective for controlling the brakes; higher or lower pressures causing very uneven working. On long runs, where the brake is used but little, some means that will prevent the pump from working itself to death is needed, and on local runs, where the brake is used a great deal, a pressure regulator that will run the pump fast until the required pressure is gained, and then ease it off, is almost an absolute necessity with automatic brakes. The regulator is placed in the steam supply pipe to the pump, the steam entering at the point marked "inlet," holding down to the seat the main valve *P*, and passing up the passage *Z Z* into the chamber *I*. The auxiliary valve *F* is held open by the tension of the spring *B* by screw *A*, which is operated by a key. The steam, after leaving the chamber *I*, passes through the valve *F*, along the port *X X*, under the main piston *M*, which has twice the area of the valve *P*, which rests upon it. Piston *M*, being twice the area of valve *P*, forces it from its seat, thus allowing the steam to pass through the valve *P* into the outlet, thence into the pump. When the pump has forced up the desired pressure in the reservoir, it acts through a one-quarter inch pipe, connected from the train pipe at *R* into the chamber *K*, forcing up the phosphor bronze diaphragm *G*, and the cricket *D D*, thus allowing the valve *F* to close with the aid of the spring *I*. Steam is shut off from under the piston *M*, and the valve *P* is forced onto its seat by the initial pressure, thus stopping the pump. The pressure already under *M* exhausts around it, and escapes through *L* into the outlet side of the regulator. The piston *N* at the bottom acts as a dash pot, its object being to prevent sudden movement, and consequent "jumping" of the pump. The passage *T T* is to afford an escape for whatever small leakage may have passed around the valve *F*, and through the holes for the cricket *D D*. The distinguishing feature of this regulator is that the pressure chamber is entirely separate from all working parts, so that dust, or any foreign matter from the air tanks, will not disturb the working.

A Chance for Arbitration.

Notices have been posted in all division roundhouses of the Chicago, Burlington and Quincy Railroad that after May 20 all engineers not able to run their engines



without the aid of pilots will be dismissed—an order which, it is said, will take off about 60 per cent. of the engineers.—*Chicago Inter-Ocean, May* 19.

Last week we were informed on every side that the "Q" had a full hand of the "best engineers to be had in the land," and now, after two months, those "good men," who can't stumble over the road without a pilot, will be discharged. This simply means that the loss of business of something in the millions since the strike, and the fact that the public are still steering clear of "Q" ticket offices, has caused the stockholders to outline a plan to re instate about 50 per cent. of the old men, but without appearing to give in. Stockholders, who have "nothing to arbitrate," will not keep on losing a million or so a month without hunting around for something to arbitrate.

An Abomination.

If there is one abomination worse than another on the average locomotive, we think the blow-off cock should wear the medal. A big, taper plug cock, located where it can fill up with sediment, and chronically leaking—one that you must loosen the jamb nuts to open, and then can't get near to close—is about as near nothing as mechanics can devise. Where there is bad water it is a great help to blow out on the road occasionally. If there is any good reason why a better cock can't be made for the same money the plug is, we would like a photograph of the reason.

Little Railroads.

Most railroad men employed upon well-known "systems" forget that there is in this country many small, almost unknown but important lines doing business and employing many men.

There is a railroad interest in the United States that is almost unknown to operative railroad men, and entirely so to the stock market. We refer to the logging, lumber and mining roads owned by individuals and firms. These roads are not incorporated, yet are of considerable importance to the communities where they are located.

There are 439 different roads of this kind in the United States, none of them over 30 miles in length. They have 2,812 miles of track; 441 locomotives, and 5,810 cars.

This equipment represents a large outlay of money, and the employment of a young army of railroad men.

None of these little feeders amounts to very much in itself, but put them all in a string and they make quite a "system."

Mysterious Pounding.

Some years ago the writer was running an old pelter that was about as loose-jointed as the average circus contortionist. She got a roundhouse rebuild—flues calked, rod brasses filed and stack painted, and the crew was told that they ought to keep her out two years.

The first trip out she crawled up hill

without making any fuss, but when we came to drop down there was a succession of pounds that made us think of a broken frame or a trip-hammer. An examination of the anatomy of the beast disclosed nothing out of place or broken; we started again; all went well just as long as steam was used, but shut off the throttle and the pound started. By observations made from the footboard while the engine was running, we came to the conclusion that the trouble was in the right cylinder.

At the first station, where we had time, we got the piston in the front of the cylinder and disconnected the back end of the main rod, but could not push the crosshead ahead at all; it was solid.

In putting up the rod, the roundhouse men had made a mistake in the guide marks, a heavy liner taken from in front and placed behind the box shortened the rod and cured the pound.

The rod was put up at just the right length to tap the front head when running shut off; while steam was being used the pre-admission, or cushion, took up the lost motion just enough to keep the piston from striking.

Rules for Reading Employes.

Following is a copy of the rules posted by the general storekeeper of the Reading Railway Company

All the employes are expected to be at their posts before the whistle is blown.

Any workman caught talking during working hours will be discharged.

Any person incompetent to fill an order will be dismissed.

When orders are given to the men by bosses they must be brief in their conversation.

Any person making a mistake in filling an order will be discharged.

Any workman who leaves the shop without reporting off will be discharged.

When employed outside and cannot be given work inside, during rough weather, must report off duty.

It is the duty of the foreman to see that every man does a full day's work.

Any person caught eating during working hours will be discharged.—*National Labor Tribune.*

The above, if true, is ample evidence that the emancipation proclamation has not been heard of or has been disregarded by the above would-be slave-whipper, by courtesy called a storekeeper

Special Notice to E. C. Centric.

Editor The Locomotive Engineer:

You do not appear to take much notice of my query as to a correct way of placing eccentrics on the shaft of a locomotive before the wheels are put under the engine, to have them come right for the lead and lap of valves. I hope the question is not too much for a journal that claims to be authority on such matters. I will anxiously wait your next paper.

Buffalo, N. Y. E. C. CENTRIC.

[Notwithstanding our advertised rule to ignore anonymous communications, and specially advertising for E. C. Centric in our reading columns last month, we are in receipt of the above query for the third time from the same E. C. Centric individual. If he will send his correct name and address we will gladly answer his question. We will take an oath not to publish his name—if that is what he fears.]

A Handy Tool.

BY J. H. COOPER.

I enclose you a sketch of a handy little tool I made to face off gauge cock plugs

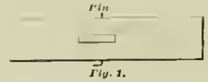


Fig. 1.

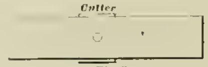


Fig. 2.

and plugs to lubricators. It is made with a piece of iron or steel, with holes drilled in ends the size of plugs, and slotted out at center for a cutter, which is held in place by a pin. The Rose reamer is used to ream the seat of gauge cock, and, using a bushing, it is used to form the cutter, which is then taken out of holder, given clearance and hardened. By this mode the seat and plug, when faced up, are exactly the same, and, I find, do not need any grinding. The holder can be made

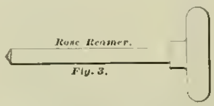


Fig. 3.

Fig. 4.

for two different sizes, as per sketch. This is not patented, and I give it to the public as a handy little tool.

Rochester, N. Y.

Friends (?) in Need.

A month or six weeks ago, there was scarcely a railroad paper in the country, that treats of everything in the railroad line, but that were vieing with each other to see who could condemn the striking engineers and firemen of the Q. in the most scurrilous manner. How hard they could condemn "organized revolution" that could "threaten the safety of the country," the "despot authority of one man," etc., was a free-for-all race for official favors that these papers hurried into. The organs of the different orders of railroad men, excepting the O R C., were, of course, with the men. Some railroad papers that are purely mechanical said nothing—which was right. But the past two weeks we note a change in those sheets that were ranting the worst; sales have been falling off, and the railroad man's own paper (?) wants him to subscribe, and now they are wishy-washy on the "unfortunate complications that drew so conservative a lot of intelligent mechanics into an unnecessary struggle with the Q."

They devote columns to lists of managers, etc., who have "come up from the ranks," pointing out the prosperous times coming that must force men now at the bench, the scoop or the throttle, up to the desks of high officials.

In these assertions they are right, but if we do not miss our guess by a long way, this late trouble has shown to the engineers and firemen of America just what friends they have in the newspaper line.

Those papers whose policy has been to stab at labor, organized or unorganized, with one hand, and accept annual passes and advertising contracts with the other, should expect no quarter at the hands of engineers and firemen.

Such papers as consider the Brotherhoods of Engineers and Firemen as organized anarchy, and a pool of railway managements a business combination, who declare that the public has no sympathy for striking workmen unless they are "actually striking for bread, or hours of rest enough to sustain life," that any body of strikers is a mob, and Pinkerton's standing army the salvation of the country, should disdain to notice the individual members of mobs.

The two Brotherhoods have not "received their deathblow," to the contrary notwithstanding.

They are organized on principles of honor, manhood and integrity beyond the conception of the lick-spittle sycophants who have assailed them.

They have put too many hundreds of thousands of dollars worth of food into the mouths, clothes upon the backs, and roofs over the heads of widows and orphans.

They have raised the standard of temperance, ability and honor of their membership too high.

Their members have become too trustworthy as guardians of human life.

Their only crime is that they have sought to obtain fair compensation for the labor they peform and the dangers they encounter.

This, then, is the curse that will throw down two institutions founded upon three such virtues as Benevolence, Sobriety and Industry.

Let the outcome of the strike on the Q. be what it may—even should every man who participated in it be tried and executed—the twin brotherhoods would recover from the blow as a locomotive rights herself after lurching at a low joint.

As well might you expect the United States to turn up its toes because the city of Boston had sunk in the Atlantic.

That there shall never be another strike we hope, that there shall never be such cause for one we pray.

The loss of over a hundred lives at Chatsworth has cost the Toledo, Peoria & Western about $166,000. All claims were settled without a lawsuit.

A Big Hole.

The great tunnel of the Northern Pacific Railway, through the Cascade Mountains, is done. It was commenced in 1886, is 9,843 feet long, almost entirely through solid rock. It cost over $2,000,000.

'Twas Ever Thus.

What has become of the locomotive with the hundred or more flat spots on each tire which was built down Boston way a few months ago? When are we to hear its cheerful hippety-hopping along the rails? There is whispered rumor to the effect that the flat spots or "facets" won't keep flat, but persist in getting themselves rubbed out, leaving the tire just like any ordinary tire without any patent on it. This would appear to be another illustration of "the total depravity of inanimate things." If you want a tire to keep round it will get flat spots on it; but if you want it to have flat spots it will get round. —*Master Mechanic.*

A Leaky Throttle.

Once upon a time there was a scrap-heap that had a leaky throttle; some of the wipers swore that it was so used to leaking that steam would continue to blow out of cylinder cocks when the boiler was cold.

This engine used to stand in the roundhouse and hiss at everything that was said. Then she would go out on the train and sizzle away till leaving time.

Once in a while the engineer would stop at a tank, get her just right, and then start on a tour of lubrication, forgetting to open the cylinder cocks. The leaker would stand this for a minute or two and say nothing, then she would swell up with indignation, and, when the long oiler was after a far-off eccentric through the spokes of a driving wheel, make a sudden lunge ahead, put a compound fracture in the snoot of the long oiler, a crimp in the water tank spout, and freeze the spinal column of the engineer as the fireman yelled: "Hold 'er there, you crazy loon; are ye trying to kill everybody?"

About twice in a while the hostler would forget the cylinder cocks and put her in the house, but if she did not have a cord of wood under her wheels she used to hook off doors or kick out brick.

All the machinists at the place had ground in her throttle, and one had gone over dry pipe and connections.

The best machinist in the place, bet a $100 dog he could grind that throttle so it wouldn't leak, and he would have lost, if a dog worth that much could have been found. He tried again, and made up his mind to grind in everything, from the mud-ring up. He elevated the dome cover, and Barney, his helper, who was no bigger than a piece of waste, wormed himself down among the braces and lay on his back on the flues, while the machinist went to hunt a certain wrench. When he came back Barney said: "Mr. 'obbins I want to h'ask you a poser; what is the hobject of this 'ere vent 'ole in the long pipe? Hits only about a 16th, but what good does hit do?"

Barney had found a hole in the dry pipe caused by the breaking out of a small piece of iron where a chaplet had been used to hold the core in casting the pipe. A copper plug in the "vent," cured the leaky throttle.

The Vance Flue Cutter.

The cuts shown herewith represent a device for cutting out boiler tubes, and is

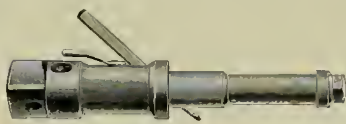


Fig. 1.

the invention of James R. Vance, a well-known boiler maker of Geneva, N. Y.

Fig. 1 represents the tool as it appears away from the work. Fig. 2 is a sectional view showing the tool in position. The body of tool *A* is arranged at inner end to hold a washer *r* of any size to fit the flue to be cut; this is to keep tool central. *C* is the cutting tool, and *e* a thumb clamp to keep it from working out of its slot; at *d* is shown a collar that serves to keep the tool in place and protect the tube sheet. The point of the tool is shown full size in Fig. 3.

Fig. 3

In use, the cutter is withdrawn until the tool is in place, then a sharp blow of a hammer drives the cutter through the flue, and the whole tool is then revolved by levers inserted in holes on shank of tool.

We have before us a piece of a flue cut off by one of these tools, and it presents a clean cut and tapering end; it is just the

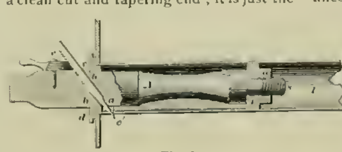


Fig. 2.

right shape for welding on safe ends, as it needs no scarfing. Tubes taken out by this cutter leave a clean flue sheet, and there are no holes to file. One man has cut off 400 tubes (one end) in ten hours. It is made in all sizes, and is especially adapted to locomotive work.

Any further information will be furnished by the inventor, as above.

To build an average locomotive in the best works in the country requires 1,300 days of labor. In another establishment 1,400 days are required; in another 1,450, and in some, where inferior machinery and appliances increase the time required, it takes as long as 1,900 to 2,100 days. Therefore it would take the labor of one man from 1,300 to 2,100 days to build a first class locomotive.—*Exchange.*

Repair Shop Hints—Good Light.

BY HIRAM R. JONES.

A dark shop with smoky windows and dingy walls, almost always has dirty floors, greasy, broken-down tools, and piles of scrap in every direction to make fit company for each other. The workmen catch the same spirit of dirt and disorder, and the work turned out will be on a par with its surroundings. "The wicked like darkness rather than light" —so do dirt and disorder.

Let in the light. Put in more windows if there are not enough. Clean up those you have. Whitewash the walls and ceiling. There is nothing like a beam of sunlight to reveal what is under the bench or down in the engine bed. Some shops are so dark that it is necessary to burn gas to see in the day-time This is all wrong, and poor economy.

A word about the kind of light. North and south windows are the best to work by, and for general shop light; east and west windows—especially in the long summer days—let the early morning and late afternoon sun directly in your eyes, which is not pleasant.

Never put a machine or kind of work that is particularly dirty in a dark place. If you do, a "hog pen" will be the result.

If a wash sink is in front of a window, it is much more likely to be cleaned every day than if in a dark corner, "suitable for nothing else." You don't see the dirt, but you can smell it.

A piece of tin or sheet iron painted a bright red and put inside the engine bed will show every drop of oil, and the engineer will see and wipe it off. It is much better than old greasy waste or sawdust.

A grindstone is quite an important tool; but because it is rather dirty and uncomely in appearance, it is stuck in a corner, with the nearest window twenty feet away, and then perhaps on the opposite side from where it should be. I have seen them put out in a shed, where the "muss would not matter," and, as a result, shunned by all. Who wants to stand in a mud puddle while he is grinding a thread tool, and then take it to the window to see if he has got the right shape to it? I say give the emery wheel and grindstone a good light.

Machinery and tools in a light place will be better taken care of and last much longer. There will be better work and more of it. A bolt or journal in a dark out-of-the-way place is quite likely to work loose or wear out before it is discovered to be out of repair.

I have in mind a model plant in this respect — shafting, hangers, belts and pulleys in a room so dark and cluttered up that a man would nearly break his neck in moving about; pumps and pipes in a pit soft with grease and mire. Verily, the man in charge delights (?) to care for such a lay out. "Let there be more light."

Staten Island Road.

The shops of the Staten Island Railroad at Clifton, S. I., are merely old board sheds, unsightly, inconvenient, small, and poorly equipped. The company operate 20 miles of road, and have 14 locomotives in service, some of the older machines being pretty ancient. The new engines are Cooke build, and of the Forney type admirably adapted to the work the road does. The road uses a good system of distance signals; the cars are heated by steam and controlled by vacuum brakes. Very bad water is used, and the writer noticed sheets of tin hung over driving boxes on some engines and eccentrics on others, to keep leaks from fire-box from cutting the bearings. There were three engines in the shop, and a set of flues just taken out showed the space between lower ones almost solid with scale. Bad water also keeps the engines dirtier than looks well for the service they are in.

Company Time.

There seems to be a desire on the part of many superintendents and managers to advertise their roads and their management by making rules governing the inspection of watches (for which the men have to pay), in many cases going so far as to name the particular watch the engineers and conductors must use. When it goes this far there is a job in it—a steal.

Most engineers buy good watches, paying from $40 to $200 for them. They are expected to regulate these fine watches by a big but inferior clock in the dispatcher's office.

Here is an engineer who has invested $150 in a fine Howard watch; it may be in a silver case, but it has got fine "in 'ards" and he knows it; it is warranted, and he knows by actual comparisons that it is keeping right on the tick with a chronometer in the jeweler's window; he goes out and the watch is 45 seconds "off" by the dispatcher's clock; he don't move it—he would be foolish if he did. The next day it is just right, and in a week it may be a minute or more the other way.

Under circumstances of this kind, considerable variation of different watches on the road is sure to exist; where the variations of watches is but three minutes in handling trains this is dangerous.

The only way out of the difficulty is for the company to own and supply to engineers good, reliable watches that are turned in the same as a report, at the end of every trip, placed in charge of a reliable watchmaker, regulated and set by him, and issued to each engineer as he goes out, just as his running orders are. A few years ago the Pennsylvania company owned the watches and furnished them to the engineers and conductors, taking receipts therefor, and allowing them to keep the watches as long as they were in the employ of the company, or the watch in good order; this plan offers little improvement over the one now in use, as it only changes the ownership of the timepieces; what is wanted is some arrangement that will insure all the watches on the road being set to one standard time and compared each trip.

New Tube Expander.

The expander here shown is the invention of T. Beverly, a boiler maker in the shops at Ellis, Kansas, and has several new and good points.

By reference to Fig. 1 it will be seen that the body of the tool is in one piece, numbered 1, in both cuts, and has plain straight recesses to receive the rollers; it has three recesses for springs that are shown in Fig 1, marked 2. They are held in place by a projection on spring in a recess marked 3; the sleeve 4, is a plain steel band kept in place by one spring shown at 5. The rollers have a small hole drilled through the center, and into this hole the ends of the springs are introduced, thus keeping the rollers from being lost.

It will be seen that by pressing down

Fig. 1.

Fig. 2.

spring 5 and removing sleeve 4, the rollers may be easily removed or replaced.

When the tool is complete there is no shield or collar, the rollers being as large as any other part of the device, and it can be used in a corner, or close up to a side or crown sheet. The tool is easily repaired, and can be made in any shop where there is a lathe. Further information will be furnished by the inventor, as above.

How to Start.

We are not going to tell how to start a train—if you don't know how, it is not likely you will get much of it to do.

We are in receipt of letters from young men all over the country, saying, that it is and has been the ambition of their lives to become locomotive engineers; some of them have had experience in machine shops or in charge of stationary plants, and all state that they have tried several places to secure positions as firemen, but the master mechanic always declared they had more men than they needed. Some of them think it strange that men so anxious to follow railroading cannot get a chance, while on the roads there are many dissolute, and perhaps ignorant men.

Replying in general to all of these writers, we would say that they all aim too high; because firemen become engineers, they wish to become firemen.

Master mechanics, as a rule, have several men employed in the shops, who have the promise of a chance to go firing, and as he wishes to keep those promises, he turns away men who apply for places ahead of men who have his word for "a show," when there is a vacancy.

If you are a young man, not an employe of the company, seek to get on the pay roll in the motive power department, in a lower capacity; leave the M. M. alone—he is busy; seek the foreman, a mechanic or a wiper, make their acquaintance, tell them you want to get to work in the shop or roundhouse *at anything*, wiping, calling, wheeling cinders or helping a machinist. Once at work, show by that work that you are in earnest and willing to do your whole duty; you cannot do this unnoticed, and you will soon have a better job; you will learn something every day; it will not be time thrown away.

When you are known a little, ask your foreman's help to get you out firing "extras"; if he forgets it, remind him once in a while, but don't hound him for a chance when it is plain that there is no chance and business is dull.

Get acquainted with some of the engineers and take a trip with some of them, on freight in the night—perhaps you won't care to go firing then.

Remember the M. M. has enough to see to with the engineers and firemen, and let him alone; recognize your foreman; be a conspiciously useful man, and let your ambition be known.

First of all get to work for the company where you can be seen; commence at the bottom—clear down—and then struggle for the gratification of your ambition.

If you were shooting snipe you would not discharge your gun until you were within range—near enough the game. Get behind some good mechanic in the shop, and thus approach the roundhouse foreman; keep on the windward side of the M. M., and don't give him both barrels until you are so close you "can't miss him."

No matter what your former experience in shops, on the water, or in stationary practice, do not try to impress your engineer with your profound knowledge of mechanics; tell him you are green as a Hottentot about locomotive running or firing, and tell him you are there to do just what he tells you the very best you can.

All you know about the strength of materials, setting valves, running or firing stationary plants or designing machinery, won't make you a good locomotive fireman. Your engineer knows this, and not to acknowledge it is simply saying that he don't know his business. The footboard of a locomotive on the road is absolutely different from any other place on earth.

If you make a first-class fireman and live long enough, you may become a first-class engineer.

Doing Work.

There are a great many locomotive engineers who seem to think it an evidence of proficiency to be constantly "doing work." They are always at the roundhouse and up to their ears in work. Not only do they pack cellars and boxes, doctor oil cups, clean headlights, and pack pistons, valve stems and cab cocks, but they set up wedges, monkey with side rods, line up crossheads etc., etc. Somehow they have got the idea that every point of the engine needs re-adjusting every trip; they never get through experimenting in the front end. They very often undertake to close up eccentric straps or file brasses, or do some other work delegated to machinists, and it is an insult to infer that perhaps the machinist could do it better; this class of men are always in trouble.

This is the man who has hot pins and break-downs, and has to open the front end on the road in order to get the chill off the water in the boiler.

The best engineers we ever knew, were men who took pains to key up their rods on the road when the engine was hot and in working condition, and then left them alone; that got the front end so that the engine steamed well, and then kept out of it; that did not report work till they knew it was needed, and then insisted on its being done; that did not do machinists' work, and did not ask machinists to do theirs; men that could get a thing about right and then let it alone.

We recently went through a roundhouse with the general foreman in charge, and as we passed an engine there arose from the pit a specter of grease, blue overclothes and perspiration that appalled us—it was the engineer. We passed on and the foreman said: "That man works night and day on his engine, and we do more work on her than on any of the rest; here is an engine run by a man whom I do not see once a month, never seems to do anything, but you can't find any brasses loose in his rod straps, his headlight is clean, his rod cups full. He does just what he is required to, does it well and lets it alone; he does all his work when he is laid out on the road or at the other end of division. His home is here and he stays at home, and when he puts a report on the book you can depend that it is no case of imagination—it wants doing." There is a goodly lot of runners, with road experience only, who think they know more about repairing locomotives than machinists; there is a big batch of machinists, with shop experience only, who think they know more about running locomotives than engineers—both of them are very much mistaken.

If you are a machinist, try to be the best one the company has got, handle the engines when they are cold and let the engineers handle them while they are hot.

If you are an engineer, be a careful, sober, everyday man and an expert runner, and when you get in go home and to bed, and let some miserable machinist actually take down the rods and file brasses on your pet engine, thinking that perhaps he will do it just as well as you would yourself.

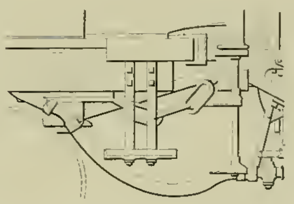
A Theoretical Advantage and a Practical Nuisance.

The accompanying cut shows the draw bar arrangement of a new express locomotive built by the B. & O. Ry. In describing the engine the *Master Mechanic* says:

"One of the most noticeable features of the design of this locomotive and tender can be seen in the angle of the draw bar between the locomotive and tender. This angle is 18 deg., and it is quite evident that, during a heavy pull, a considerable vertical pressure is brought to bear upon the back of the locomotive, thus increasing the weight upon the drivers and lessening that upon the trucks. This we suppose is the purpose of the design, and it seems as if it would make an efficient automatic traction increaser."

The writer of this article has fired and run locomotives with this breed of draw bars, and can sympathize with othe. men who have it to do.

When an engine is pulling hard, there is no doubt that this draw bar lifts up the front of tank and transfers its weight to



the drivers, but it opens the space between the friction plate and the tank wedge, and causes a pounding and jerking that makes the engine ride very uncomfortably.

The tank is raised up in front and becomes a little see-saw sideways over the draw bar, and a fireman wants to be a sailor to be able to stand up.

On paper they help to pull cars; on the road they are elements of "grief" to the men. Make them as near straight as possible.

Improved Link Motion.

A writer in the *Engineers' Journal* tells the readers of that paper that he has gotten up an improvement on the link motion. He claims to have slotted the lower end of his rocker arms and put therein a movable block that moves up when the engine is hooked up between the 10 inch and center notch, but when lever goes back of center the new block returns to place.

He claims to have given this motion a practical trial, and says it is the thing for high speed, as it makes the valve release earlier.

If it were possible to do just as this inventor says he does—which we doubt—his slot arrangement, when in gear, would simply be handling the valve about as the link would do at 10 or 12 inches. The woods are full of men who are improving the link motion—in their minds.

We would like to know how this change affected the lead on our inventor's engine and how much lead he thinks of benefit to an engine.

Air Brake Practice.

BY J. E. PHELAN.

Second Paper.

Straight air appliances have not altered any, or improved in principle, to date. Its use is rendered possible with automatic appliances by a 4-way-cock used in connection with all triple valves excepting those recently improved. This 4-way-cock, when handle is in horizontal position, places triple valve, auxiliary reservoir and brake cylinder in communication with main air pipe and air supply. When it is turned midway, it cuts off triple valve, auxiliary and brake cylinder from air supply, and renders brake useless for air appliances. When the handle of this cock is turned down, it cuts out triple valve and auxiliary, rendering them useless, and opens passage from main air pipe and air supply to brake cylinder, for straight air, same as though triple valve and auxiliary had not been invented.

This 4-way cock attachment to triple valve is left off from latest appliances, and evidently straight air practice with it; and in light of such circumstances, the triple valve and auxiliary reservoir in future are for use and not for ornament.

With improvements, the principle of the engineer's brake valve has not altered. But as improved, and in use now generally, it is the medium through which auxiliary reservoirs are supplied with air, and when handled right, retains 20 lbs. more air pressure in main air reservoir than it transmits to train pipe and auxiliaries. This 20 lbs. reserve pressure in main reservoir is desirable and often necessary in insuring release of brakes by its action on triple valve in forcing it up to its true position for releasing brakes, and receiving supply of air. The 20 lbs. reserve is always insured, with engineer's valve clean and in good order, by having spindle or lower point of spring in handle, rest against middle stop in its travel around outer rim, or top of valve chamber. This relates to engineer's valves in general use. The new engineer's valve has still another stop, and its principle of improvement may be explained later.

With automatic air, custom and practice of some engineers has dictated the cutting out of at least ⅓ of brakes in train, after every alternate car, in freight trains of 20 cars. When brakes are in good repair such practice is wrong, and only demonstrates poor practice on part of those favoring such methods. Brakes should apply throughout the entire train. The stop-cocks in end of pipes at ends of cars just back of hose connection should receive special attention, and always be open—handles pointing down—when brakes are in use, excepting the one in rear of last car, that must remain closed.

Many failures of air brakes could, no doubt, be accounted for by knowing probably, but one of these stop-cocks, not far back of engine, being shut off. The best way for engineers to detect such neglect is when trying air brakes, before starting from terminals, or points where air couplings may have been coupled.

If engine is coupled and air connection not made, in setting brakes air escapes through engineer's valve lightly, and air pipe being quickly emptied of air, the air gauge indicator acts quickly in going toward zero. The indications correspond in degree for one or two cars, and can be quickly detected by an engineer acquainted with conditions. When full train is connected, air flows out with indications of having a volume of pressure back of it; air pipe is not easily emptied of air, and reduction of pressure, as shown on air gauge, is so much slower, and each let up in escaping air is followed by gauge indicator rising again from effect of pressure coming from rear cars. The new engineer's brake valve will alter such conditions, so far as not showing effect on gauge, of air flowing from rear cars to increase pressure on forward cars. This flowage of pressure from rear to front cars by improved triple valve is utilized by passing from main air pipe to brake cylinder, thus going to set brakes; at same time continuing reduction of pressure throughout the train and causing prompt action of all brakes.

Handy Tender Step.

On many engines the step on side of tank is in the way of hose, and is often trappy because its hangers are loose. A step that any one can easily make and put on is a square piece of ½-inch iron, as shown. Drill holes to fit long bolts that hold box on front tank truck to angle irons, and bolt the plate to top of box. No hangers in the way. When truck is too far back, a step on front box in addition to the regular step is a convenience and often an element of safety. Such steps are in use on the elevated roads of New York and Brooklyn.

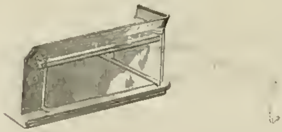
A Safety (?) Jumper.

A Wisconsin inventor has got a patent on a device to let railroad men jump a good distance from the track.

The device is so novel we illustrate it. As will be seen, the arrangement consists of a barn-yard gate hinged to side of tender, one on each side (we suppose). In case of a wreck, collision or derailment, the bold engineer gets his dinner pail, coat, and time card, places his foot on the step, pulls the string, and swings safely toward a field of high oats; the fireman grasps the tallow pot and leaps into the darkness, *via* the gate.

Of course they always have lots of time for gate swinging. There is a self-regulating windlass concealed in the gate frame, and the jumper can take hold of the ring shown and it will lower him gently and drag him as long as he has breath to hold on.

We imagine that if any of the boys would practice on this scheme of escape, that by the time the victim had been dragged through a few patches of brush, knocked over a couple of switch stands, dove through a cattle guard, and butted his brains out against a bridge, that he would



prefer to just simply fall out of a side window and take his chances with the mud-hens in the ditch.

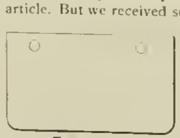
Correspondence

A Hospital Victim.

Editor The Locomotive Engineer.

I read with interest the article on Hospital Steals, and in support of the truthfulness of that article I would like to give you a little of my experience with corporation contract doctors. While in the employ of a certain company I had my hands scalded and the backs blistered badly (I am a boiler maker.) The doctor gave me a bottle of lotion to wash them with. He gave me strict orders not to cut blisters or let the water out until they broke. I went to his office daily for a week; my hands seemed to be just the same as when I went to him at first, and showed no sign of breaking. I suffered terrible pain all that time. I was prevailed upon by friends that witnessed my suffering to try an old lady that made a specialty of such cases. The first thing she did was to let the water out by cutting the blisters. I was relieved of all pain immediately. She showed me what caused the pain—the water had eaten into the flesh and formed matter. She said I must not take blistered skin off, as it would peal off as new skin formed underneath.

Now, the rules of this company in the matter were practically as stated in your article. But we received so much cash per week while disabled. If not a hospital case we must go to that contract doctor, as he has to give you the order for your pay. I



TENDER STEP.

had to wash off the salve, the old lady put on, every day before going to see the doctor. After a few days he was astonished, my hands were getting along so nicely. At the same time he would pat his bottle of lotion with his fingers and proclaim it could not be beat for scalds; but that bottle went into the first vacant lot I passed. But one day, just as I considered my hand all but cured, he ripped the blistered skin off before I discovered what he was doing, and took the new skin with it. That was too much for me. In my anger I went for him, and told him he would never get the chance to do that again, and I had been receiving other treatment. I got no pay for those four weeks. We held several meetings (there were 2,000 men interested) and tried to dislodge that doctor, but we found he was a Gibraltar.

JAS. HERON.

Buffalo, N. Y.

Drivers, Stokers, Fitters and Blunders.

Editor The Locomotive Engineer:

Having become a subscriber to your valuable paper I would wish, through its columns, to say a few words in regard to a matter I have heard debated many times. Many old and experienced drivers advance the theory that mechanics, that is, locomotive fitters, make indifferent drivers. Now I would like to know how such theory can stand? Who, I would ask, should know better what is under his feet than he who makes and places it there? Who should have a better idea of the strain and tension on every bolt and pin in an engine? Why, I have heard a good driver ask a turner who was turning up piston rings, if they were cast or wrought iron. Imagine, then, what idea he had of metals in general. It is ridiculous to assert that a man can, after a time firing, be competent to take charge of an engine. Is it the case on our ocean steamers? An engineer should be an engineer in every sense of the word, mechanical, practical and theoretical; outside those necessary attributes I consider any driver but a laborer. Every man, in my estimation, who wishes to drive a locomotive, should, like engineers on vessels, pass an examination as to their fitness for such position. It will, I am sure, be the means of securing more safety in travel, and the saving of a large amount of capital.

MECHANIC.

Quebec, Dom. Can.

[Engineers are not sent out to test strains on bolts or pins, but to pull cars. If the officials of the road put on trains too heavy for the bolts or pins, the engineer is not expected to argue about the strains, but to pull the cars or break the pins. Engineers do ask foolish questions about shops, but they do not get much the best of shopmen on the road. Engineers on vessels pass examinations on the engine only; the captain, mate and pilot have to pass another on the handling of the craft, signals used, etc. A locomotive engineer must pass *all* these and more. To pass an efficient examination on *handling* an engine over the road, would debar the best mechanics from becoming engineers—unless they had road experience. Engineers are foolish to say a machinist cannot learn to be an engineer. Machinists are equally foolish to think a man with road experience only cannot be anything but a laborer.]

The Way the Road Men Feel.

Editor The Locomotive Engineer:

I was pleased to read your article on "How and Why Injectors Work;" for there is a large number who do not think the real cause has ever been discovered yet. The chap I sling coal for, a good, practical man, told me, when I tried to tell him he could find the principle explained in some good work on the steam engine, it was all bosh, for it was a mystery to-day as much as it was twenty years ago. I heard an M. M make a statement not much better a short time ago. The paper on the air brake is another good start for the boys, for that is a thing we should thoroughly understand. I hope you will soon be able to make THE LOCOMOTIVE ENGINEER a weekly paper.

Halifax, Nova Scotia. FIREMAN.

Care of Locomotive Boilers.

Editor The Locomotive Engineer:

In making out reports of repairs required, and general condition of, locomotive boilers, it is a disagreeable duty to me to have to report water spaces mud blocked, more especially so when the diagram with report shows the mud block to be in close proximity to an inspection plug, where ordinary care could have prevented its formation there. I am willing to admit that washout plugs are sometimes put where there is little chance of being taken out, except when the engine is in the back shop for repairs, and freely grant that the time allowed for doing the important work of washing out a boiler is frequently too short to allow of its being well done; but no reason exists why plugs easy to get at should be allowed to remain untouched for months at a time—except, perhaps, a morbid dislike to too much work on the part of the washer-out. This individual should be supplied with a set of water space torch rods, and required to use them. If a boiler-maker is around, he should examine the water spaces with a light, after the boiler is washed, and see that everything is O. K. Staybolts are often found broken, and some that sound good under the hammer test are found to be defective when the water spaces are examined with a light. A piece of clean waste, well soaked with benzine or kerosene, makes a good light to use on a rod.

In your Roundhouse and Repair Shop Notes for May, you state that the practice of the day seems to be to see how many flues can be crowded into a locomotive boiler. In my humble opinion, this practice is wrong. I think more economical results would be found if the spaces between flues were wider apart—say seven-eighths or one inch—than where flues are kept so close together. Any one knows, who has ever been inside a locomotive fire-box, that an engine is not in service long before some of the flues in the outer rows are choked with cinders, etc., rendering them practically useless for the purpose they were intended for, namely, heating the water surrounding them, and converting it into steam by conducting hot air, combustible gases, smoke, etc., from fire-box to smoke-box. If the flue area thus lost by choked flues was distributed through the boiler in water space, by allowing wider spaces between flues, circulation and ebullition of water would be more evenly diffused through the boiler, and no loss of heating surface follow, as compared with present practice. Where flues are crowded together, the outer rows are plugged with dirt, the heat centralized, ebullition is more violent and leaky flues common.

If I was a fireman, and wished to save the railroad company money, and myself lots of hard work, I would try and keep the crown sheet free of those hard, gritty lumps of incombustible matter which adhere to crown-bolt heads, safety plugs, etc., until the crown sheet is covered with it to a [illegible] of several inches. Sometimes the [illegible] are nearly choked with it. This stuff, as a non-conductor of heat, will rate A 1. It must be evident that a lot of good heating surface is lost on the crown-sheet, and in the reduction of effective flue area, by its being allowed to remain on the ends of flues. It is not hard to remove at first, but if allowed to remain for a time, considerable difficulty is experienced in removing it. A BOILER MAKER.

Hamilton, Ont.

Another Wedge Fastener.

Editor The Locomotive Engineer.

Some of the new engines on our road, the B. & O., have the wedge bolt fastened in the wedge, and the bolt extended through the brace to a separate bracket, as shown. It seems to work well, and you can screw the wedge down as well as up. 631.

Baltimore, Md.

Another Air Pump Question.

Editor The Locomotive Engineer

In reply to F. M., Greenbush, N. Y., I would say that I did examine all air valves of the pump in question and found them all right. Furthermore, that I did not say anything about a "terrible pounding." From the tone of his answer I should infer that he (F. M.) had jumped at his conclusions without giving the matter proper investigation. Now T. J., of Schreiber, Ont., takes the right course in giving the subject proper thought, and the result is that T. J. has won the cigar, and I will tell him with pleasure what I found.

Some one at the other end of the division had been working at the pump, and while the top head was off had in some manner dropped a pine plug (probably a substitute for a cork in the oil can which was used while working on the pump), in the exhaust port or cavity on the side of cylinder, which almost closed the exhaust passage from upper end of the cylinder, causing no small amount of back pressure. After removing the obstruction the pump worked all right.

I will join T. J. in praising THE LOCOMOTIVE ENGINEER, and add that I hope it will prosper and grow to that extent that you will be obliged to issue it every week, and that very soon too.

Now here goes another conundrum for the boys. Sometime ago Engine 600 came in, and Uncle Rube Allen (who ran her at that time) said his air pump stopped working very *abruptly*, and he could not start it again. Well, I went to work at it, and, as I had always done, I loosened the reversing valve and cylinder caps before loosening the head (because the caps sometimes stick pretty hard), and on removing the reversing cylinder cap I noticed that the reversing piston was at the top of reversing cylinder; I pressed it down, put both caps on again, gave the pump steam, then the main piston moved up to end of stroke, returned to the lower end of stroke, and stayed there. I again took off reversing cylinder cap, found reversing piston up as before; I pressed it down, put on the cap, put on steam, and it acted the same as before; I then removed the cylinder head, thinking perhaps the steam passage leading to the lower end of the reversing valve bush was stopped up, but found it all clear. Then I thought perhaps the wings of some of the air valves might have broken off and worked under the air piston, which would prevent the main piston traveling down far enough to draw reversing valve stem down and reverse the motion of piston. I took off bottom head, found nothing; took out main piston and found nothing. I put everything up again, tried the pump, but no go. It was now about midnight, and I was tired and mad, but would not give up, so off comes the top head again, and I found the trouble, and it was so simple that I could have kicked myself for not discovering it before.

Another cigar for any air pump repairer who will tell me what the trouble was.

Syracuse, N. Y. W. F. R.

How They Do Us Up.

Editor The Locomotive Engineer:

Not long ago I was in a large machine works, and was being shown around by one of the proprietors. I was somewhat interested in a large three-spindle drill.

It was merely three drill presses mounted on the side of a 20-foot bed, and they could be moved along its length, or be used in any place independently of each other. An attendant was in charge of one, and on one spindle was drilling a lot of castings; on another he was drilling and countersinking holes in long wrought-iron straps, and on the third he did any odd job of drilling that was wanted. As I looked so interested, the owner said: "That tool was intended for long work, where a lot of holes are needed, and all three spindles could be working at once, but we find it pays to keep them on little work; one man will run them and not realize what he is doing, but ask him to run three separate drill presses and there would be a strike."

We went out into the yard and saw a great consolidation "hog" go by with 60 loaded freight cars, where the old eight-wheelers only hauled 28 loads a year or so ago.

The engineer receives the same pay, and while his responsibilities have been increased he does little more actual work.

But with the fireman it is different; where he formerly burned from two and one-half to five tons of coal in a hundred miles he now burns nine; he not only has to break up this much more coal, but he has to lift it, and he has to throw it 11 feet, instead of four. He also has to clean an engine as big as three of the old ones. Now these firemen are getting the same pay they got on the little engines. Here is a case of doing at least three times the amount of work, and in furnishing steam to haul over twice as many cars, for the same money. If these men killers were not so big and so hungry for coal I should say give the fireman more pay, but it is really too much work for any one man to stand up under and protect his health at all. All locomotives having fire-boxes ten feet in length, or all locomotives burning over ten tons of coal in ten hours, ought to have two firemen, and the law ought to say so. H. D. DOYLE

Denver, Col.

Where It Is Better Managed.

Editor The Locomotive Engineer

In looking over the columns of your journal I see some correspondent writing on the Railroad Hospital, in which he terms that institution a swindle.

Now, I fail to see his point in calling it a big steal. I have paid hospital fees for the last ten years, and have never had one cent's worth from a hospital as yet, but I do say it has saved me many a dollar, for if one of our men comes in from the road sick or mashed up we send him to the R. R Hospital. Now, can any one say he has not a good room to stay in? You certainly know he has. Is the writer aware that the man is not compelled to have a hospital doctor if he or his friends are able to pay for a doctor? Now, if he wants another doctor they can, of course, get one, and the prescriptions are filled gratuitously at the expense of the hospital. Board and washing are also furnished the patient while in the hospital. Is this nothing for our money? I am surprised that our railroad men are so blind as not to see where their own interests lay Now, I am a married man; suppose I get sick and want my family doctor; he prescribes for me, and then I can send it to the hospital drug store and have it filled. Such is the arrangement at our hospital, and I for one do most cheerfully endorse it for the benfit of my fellow workmen.

My men on this road wanted me to have it done away with. I explained to them the benefits of it, and they have all concluded it is a good thing and wish to continue it. It is to be remembered that doctors are like engineers and machinists, they like good wages after spending thousands of dollars to learn the profession, besides several years of labor. Let gentlemen weigh this matter well, and if I have committed any error in this article it is more of the head than the heart. I will close by saying that I consider the R R. Hospital a godsend to poor homeless railroad men. E. A. CAMPBELL, M M.

Houston, Texas.

[Our correspondent is where the men have a little latitude; as a rule men can get medicine from a company drug store only on order from a company doctor. What the writer objected to in the original article was the fact that the men pay the expense of repairs for "mashed up" people, instead of the company.]

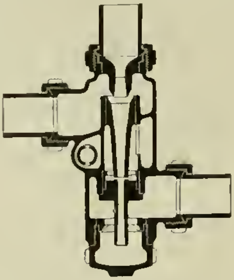
There has been an unusual number of locomotive boiler explosions this spring.

Injector Currents.

Editor The Locomotive Engineer :

The interior of an injector has always been a mysterious interrogation point to me. Just about as soon as I come to the conclusion that I have got the right idea, along comes something that shakes my faith in my own information.

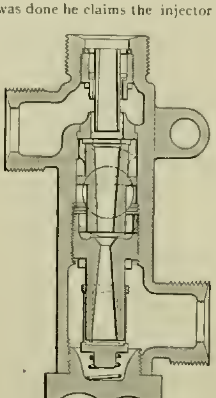
The last issue of THE LOCOMOTIVE ENGINEER had two articles on this subject that seemed to me just right; but I have



SELLERS' "NON-LIFTER."

had a little experience lately that has got me "off" again.

There is an old runner here, and he is considered extra well informed, who insists that the range of an injector depends in a great degree upon the turns in the feed pipe and the obstructions the water meets with after it leaves the delivery tube. On his engine they put up an injector, with an elbow in the pipe only about a foot from the injector, and he kicked about it till he got it out, and had all the turns made nearer the check. Since this was done he claims the injector does



RUE "FIXED NOZZLE."

better in every way; on top of this comes an article in another paper, telling how an injector failed to work because the brazing of a joint in copper feed pipe was rough and broke the current. Now if all this is so, how is it that the fixed-nozzle injector, made by the Rue Injector Co., and the non-lifter, made by the Sellers folks, will work when their delivery tubes send the water directly against a cap and the feed pipe is at right angles to tubes and *above* them, so that the current has to turn clear around?

I wish you would print a view of the *innards* of these two squirts, so that us fellows who have got currents on the brain can see what is what.

Tyler, Tex. TEXAS.

[Cuts asked for by correspondent are published, and show change of current as he states; nevertheless they work admirably.]

Fastening Follower Bolts.

Editor The Locomotive Engineer :

While men are scheming to get some form of lock that will prevent follower head bolts from working out, I should like to remind some of them of an old scheme—and a good one. It is in use on some Eastern roads, and is much used in Europe, both in locomotive and steamship practice. Each bolt head has two one-eighth inch drill holes through the head, and the follower has a channel cast between each bolt hole, just deep enough to hold a one-eighth inch copper wire. After the bolts are all in, the wire is strung around through all bolts and fastened. A bolt cannot work out without shearing this wire. I believe that this device is as simple and efficient as can be devised for this purpose. But all the ingenuity that can be put into a locomotive piston cannot compare with a good, solid head—that is, in the opinion of your SUBSCRIBER.

The Dalles, Oregon.

Problems from the Footboard.

Editor The Locomotive Engineer.

The nozzle of a locomotive plays a very important part in hauling trains, still, as you say, in your April number, steam is necessary to pull cars, but every pound of back pressure on the piston means one pound less hauled. I always went in for the largest nozzle possible, and rather than reduce them have put in smaller blast, or petticoat pipes, sometimes putting liners in the bottom of the stack, ten or twelve inches long, reducing the diameter from two to three inches, and by so doing have been able to open the nozzles ¼", and making plenty of steam on far less coal. On some roads I have known the boys to put a piece of ⅜" round iron, wedged tight across the center of the nozzles—a "split." It did not reduce the area very much, but it worked wonders on some engines. There was only one way I could account for these results, that was that the strip of iron split or spread the current of exhaust steam, and made it fill the stack, thereby producing a greater vacuum in smoke arch and tubes, and more complete combustion. The trouble with many engines to-day is the stacks are too large, and the exhaust acts like a very loose plunger in a pump—not doing more than half its work. Some years ago we got a Wooten engine, Baldwin build, it had a 5" single nozzle, with a plug in the center that could be raised or lowered from the cab; there was a register in smoke box door, the grate was 96" x 102"; we used Cumberland coal; it made steam very free. I took the plug out of the nozzle, then commenced cutting off the top to enlarge it, and finally made a new pattern, and when I left the road that engine was running a six and five-eighth inch ($6\frac{5}{8}$") single nozzle. Mr. Angus Sinclair said it was the largest nozzle in the United States. It was a picnic to fire her. But her good qualities were spoiled by the M. M. ordering the fireman to shovel snow in the fire-box during a snow blockade, to dampen the fire; this made a steam inside the flues, and the smoke and ashes formed a scale inside, and the nozzle was reduced to 5", and she was like a waterlogged ship. Jones' portable hoist, in the April number is good; it can be used to lift steam chests off also. I am glad to hear so many praising The Locomotive Engineer as the spiciest little paper out.

Considerable has been said about sight-feed cylinder oilers; they are good when kept in good order, but if the oil gets gummy, or anything gets in the valves, they get stubborn, and refuse to work or else work too fast. I once saw an engine with a quart Dreyfus cup screwed into a cross on top of smoke arch behind the stack, and a pipe led to each steam chest; in winter time, when very cold, a box was put around it, to keep it from feeding or condensing too fast; this cup worked first-rate for many years, and gave very little trouble.

It is often thought to be a disgrace for an engineer to have his engine towed in, and he ought to use every effort to bring his train in, but this is often a risky business on roads where traffic is heavy. But some men soon get badly scared and go off at half-cock, or make no effort to help themselves. I once went after a broken-down engine and found train on main track and engineer sitting on fence. When asked what was wrong, said the flues leaked, and he was afraid he would burn her. An oak sapling was cut down and a plug pointed and drove in, and very soon she hauled the train at good speed. At another time we had the back driving axle of an 8-wheel engine break, just outside the R. B. box, the wheel fell over, twisted off the side rod, and rolled down the bank; the engine staid on the track; being but two miles from town, the brakeman was sent in for help. We took a hand car and ran down, looked around, took in the situation, got a chain and made fast to the bracket on right side at back end of engine, and to the left front corner of tender, took a twist on it and drew the engine over tight on L flange, making the tender bear hard against right rail, and pulled out and went in on three legs. It is always well to be prepared for these things, and if an engineer don't make some preparation, by having chains, extra blocking, bell cord, saw and ax, etc., he will find the road a poor place to hunt for them.

Watertown, N. Y. J. J. Bingley.

Link Blocks.

Editor The Locomotive Engineer:

Whenever you or your readers get tired of my growling, just get out your cheese knife and guillotine my effusions.

I had a little experience the other night with a link block, and ever since I have felt mad.

I have had considerable experience with different kinds of link blocks, but most of my trouble was to keep any kind of waste or wool in the holes, and the first builder that fixes a simple arrangement in the block, that will stay, and keep the hole full of waste, and come in contact with the sides of the link, will receive a vote of thanks from the undersigned.

A good kind of a block was the solid one like Fig. 7; it was always there and was simple; but, of course, it couldn't be used with a solid link; the next breed was in two pieces put into the link and riveted there. It looked like Figs. 2 and 3, and I thought it was a poor scheme if riveted into a solid link. The common kind, to me, is like Figs. 4 and 5; it is made in two pieces, the block proper with one side plate solid, and the other, next the rocker arm, loose, but held in line with the block itself by a dowel pin, shown at *a*. Now, all this family of blocks would look like Fig. 6, if they were sawed in two through the pin.

I took out a new engine some time since and helped a train over the road, returning "light." It was night, and the road

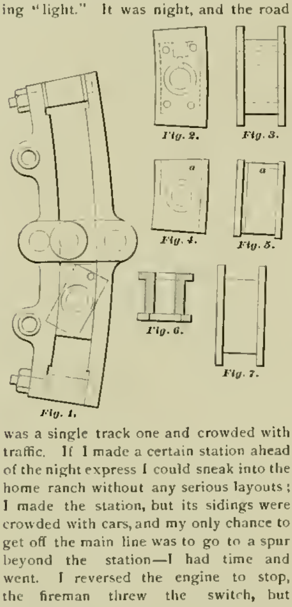


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

was a single track one and crowded with traffic. If I made a certain station ahead of the night express I could sneak into the home ranch without any serious layouts; I made the station, but its sidings were crowded with cars, and my only chance to get off the main line was to go to a spur beyond the station—I had time and went. I reversed the engine to stop, the fireman threw the switch, but when I tried to get the reverse lever pointed toward the stack it wouldn't point—something was striking solid, and my first thought was that it must be a broken valve yoke or a cocked valve; still I could move the lever for a notch or two in the corner. About this time the headlight of the express jumped around a corner about two miles behind, and made straight at me at about forty miles per hour. There was not much time to think, and very little to act, but before you could say John Spoopendike, the fire-boy, was making passenger train time down the track with a red lamp, and I was on the ground with a torch, looking for the cause why. I found it the first look—the dowel pin on that measly link block plate had come out and the plate was tipped ahead, as shown in Fig. 1, and caught a bolt in the link saddle. As long as I was working the engine near the center it was all right, but as soon as I pulled her into the corner the block came below the saddle and caught. I straightened it up, but it would not stay, and I looked for something to hold it; the first thing I saw was thick mud, and inside of a second a handful of this was holding that plate up straight; I lost no time in getting into siding and shutting the switch. The express passed, and I made up my mind to get even with that block. The first thing I came across in the tool box was a round file, and the end was just about as big as that hole; I drove it in with a soft hammer, and about 4,000 pounds of bad temper, and then broke it off flush. I reported a new pin needed, but they could not get the one out I had put there very easily, so they left it, and for all I know it is there yet. I don't like them.

John Alexander.

Packing Air Pumps.

Editor The Locomotive Engineer:

Of all the mean things to pack on earth, a Westinghouse air pump is the champion.

If you pack the lower or air gland first, you can't get the other gland down far enough to get a knife into the cavity.

If you pack the upper one first, you are stuck, for the lower gland and the big nut around it has to be held up while being packed.

In eleven cases out of ten, the pump will not show a sign of needing any wading till you have the scrap well out on the road, then she will blow and you will have to "put in a ring" at the first stop, while you are standing on tip-toe on the end of a rotten tie, and the pump registering about 400° in the shade.

Ordinary packing hooks and irons are too big to use, and, prying and twisting around, scratches the rod and jams up the nuts; the threads at the ends are the only ones in use, and, being soft brass, soon wear until they will not hold until they are on about three turns. The loose gland inside the nut sticks to the latter and turns on the packing, disarranging it.

A much better arrangement would be to discard the gland or collar, and the present stuffing box, make the brass fit the piston rod closely, and make the nut as deep as possible, putting all the packing into the nut; it would be easier to get at and cheaper to make and repair.

The Westinghouse company make a metallic packing which they sell for locomotives; if it is any good, why don't they put it on their pumps, and let us see a good thing in a place it is needed, and needed bad?

Kansas City, Mo. John Reynolds.

H. K. Porter & Co., builders of light locomotives, Pittsburgh, give the following rule: To compute the number of tons of rail needed to lay a mile of track, multiply the weight of the rail per yard by 11 and divide by 7. All rails are sold in tons of 2,240 pounds.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS.

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

☞ *Mailing address of Subscribers can be changed at any time. Both old and new address should be stated. Prompt notice should be given whenever papers miscarry.*

☞ *Entered at Post Office, New York, as Second Class Mail Matter.*

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CONTENTS.

Blacklisting.

On April 5th the Iowa Senate passed the House bill forbidding railroads from blacklisting their employes. It makes exception in the case of employes discharged for gross negligence or drunkenness, but provides a stern penalty for attempting to prevent employes discharged for other reasons from obtaining similar work elsewhere. It is designed especially to cover the case of railway employes who are blacklisted for engaging in strikes, or who for any reason incur the disfavor of their superintendent.—*Railway World.*

Most States make blacklisting a crime and punishable by imprisonment, but there are still a few cringing, cowardly men who get into petty offices, who, for personal spite, will prevent men whom they have discharged from obtaining employment on other roads.

Railroading is as much of a trade as stone-cutting, and as much of a profession as dentistry. If any man could vent his spite on a dentist or a stone-cutter by preventing him from working at his trade or profession, and thereby rendering lost and useless his years of apprenticeship and study, there would be war. Yet this is done to railroad men all the time.

Honorable and fair-minded men who are railway officials do not use or approve of the practice, yet they do not condemn it as they should.

We should like to see some railroad manager that is man enough, brave enough, hero enough, to nail upon the bulletin-boards of his road an order something like this:

Notice.

TO WHOM IT MAY CONCERN.—While the undersigned is manager of this road, no employe leaving the service of the company, *under any circumstance*, will be blacklisted. Ex employes of this road may seek employment elsewhere, and if officials of other roads ask for reference of this road, I have instructed all officers to reply that such a man was employed for a certain length of time in a certain capacity, without other comment of any kind. The laws have made blacklisting a felony, and it is such, and due notice is given that I shall uphold the law. Any official of any road who sends a blacklist to this road may expect that I shall at once place it in the hands of the person so blacklisted, and furnish all evidence in my power tending to the conviction of the criminal.

Signed, —— ——.

We hope that every railroad official in this free land who ever again uses the blacklist to prevent any man from earning his bread at his chosen calling, may find his just deserts in a prison cell.

When some official comes out in well-set terms and declares war upon the damnable practice, we want to show up his picture on our front page, surrounded by a garland of laurel, as a hero in a class where heroes are not supposed to exist.

About Brake Leverage.

In commenting on the remarks of a correspondent last month we omitted to fully qualify a certain statement on the retarding power of brakes that might lead to the formation of wrong ideas in the mind of earnest students.

Referring to the practice of putting driving brake shoes over the flange of the wheel, we said: "The retarding power of a brake is the power applied to the shoe, and the distance from outside of tire to center of wheel." This statement is altogether too broad. In the case cited, the brake on the driver flange gave that brake more retarding power than if it was on the tread of tire, and so it would have more power the higher the flange was; but coming down to brakes as usually applied to the same place on wheels that comes in contact with the rail, the distance from outside of tire to center of wheel has nothing to do with the retarding power of the brake.

The size of the shoe has nothing to do with it. It is entirely a matter of how much pressure is forcing the shoe against the wheel.

Suppose a locomotive to be running at the rate of 30 miles per hour, she has six-foot drivers, and three-foot truck wheels, each wheel under the engine, regardless of size, is traveling 30 miles per hour; if you apply a brake shoe to each wheel with a pressure of 100 pounds each, the three-foot wheels will hold just as much as the six foot ones. Because while the six-foot wheel has rubbed its shoe through one revolution, the three-foot wheel has rubbed its shoe through two revolutions, representing the same retarding power in the same length of time.

The Car Coupler Row.

The Master Car Builders' Association has adopted the Janney type of automatic car couplers. It appears now that there is a quarrel between the Janney coupler folks and some of the car builders, or their managers, about just what constitutes a Janney coupler. The contour lines adopted do not exactly coincide with the lines patented in 1879 by Mr. Janney. The litigation likely to grow up out of this controversy will very likely extend the time that will ensue before the general adoption of automatic couplers will take place.

If the patents of Mr. Janney, taken out some twelve years ago, cover the opening head principle, he is entitled to the profits of this invention, and nine years of expense in demonstrating that that class of automatic coupler was the best. The howl about paying royalties is the last kick of the companies against adopting a safety appliance that the public demand. As to the difference in the contour lines, there is very little, and we have yet to hear it disputed that the Janney lines are the foundation on which all modifications are built. The Janney coupler folks should not be considered home missionaries. If they have an invention that the railroads want, let the railroads pay a reasonable price for it.

While the managers and the coupler companies quibble over a matter of dollars and cents, the ghastly harvest of life and limb goes on.

Automatic Brake Lessons—Written in Blood.

Two fearful accidents have occurred within the past month by the explosion of giant powder or dynamite loaded in cars. According to the press reports both accidents were caused by trains breaking in two. In the accident at Locust Gap, Penna., the broken sections of the train came together, causing an explosion of several hundred kegs of powder and 12,000 fulminate caps, tearing down almost all the houses in a little village, and killing a number of people.

Near Fountain, Col., a freight train broke in two, and five cars and a caboose ran back down a heavy grade, striking a passenger train and bursting an oil tank car and setting fire to the wreck. In one of the cars was 17,000 pounds of giant powder, and its presence was discovered by the passenger train conductor, and warning given, but too late for many; several people were killed and many wounded. Had either of these freight trains been equipped with a reliable automatic brake, the runaway cars could never have started. Either accident will cost the companies enough in damage suits to equip the entire system with reliable brakes.

The daily harvest of dead trainmen has attracted little attention from the press or the public, but a few awful lessons like these will practically boycott all roads, not using reliable automatic brakes on freight as well as passenger trains.

Two Kinds of Scalpers.

That philanthropic and self-sacrificing body of men, the "American Ticket Brokers' Association"—called by the scoffing world "scalpers"—is holding its tenth annual meeting at Detroit this week. The call declares that "the ancient enemy of the honest broker"—meaning doubtless the necessarily dishonest railway officials who oppose ticket scalping—"has been routed, but his hosts are rallying for renewed assault, and the brokers must show him an unbroken front." Certainly. And why not secure the passage of State and national laws prohibiting railway companies from selling their own tickets, and putting the business, including the fixing of rates, in the hands of the always "honest broker"? —*Railway Age.*

If all railroad managers would make all tickets "good for one passage" from one station to another without limits of time, trains, conditions of signing same, and all the other "ifs," there would be little business for brokers. When the ticket goes out of the possession of the company they receive their own rate for carrying a passenger a certain distance, and they should be compelled to perform their part of the contract upon presentation of their ticket. No one fixes their rates; it is their own scheme to avoid delivering goods that they have sold, and received their cash for, that causes the trouble.

Vanderbilt pays his cook $10,000 a year and his engineers $3 a day each. Difference between a cook and an engineer, $8,905.—*Solid Muldoon.*

Shop Rules.

How many shops and roundhouses are there in the country where there is not posted some rule or set of rules to govern the men. If there is nothing else, "No smoking" is pretty sure to stare you in the face.

In very few cases are the rules lived up to—especially by the foremen.

Men are not school children, and do not need a standing notice how to walk, act and talk.

A set of cast-iron rules are a standing insult to the intelligence, manhood and independence of workmen.

If you are in charge of a shop and must have rules, tear down your old ones and substitute one reading:

"Employes are expected to do what they consider just, fair and honorable to the company, the foremen and themselves. Men not capable of judging between right and wrong will not be retained in the service."

There is no standing insult to manhood in this; you put every man on his honor, and a man who will not do twice as much work on his honor as can be got out of him by case-hardened rules, threats or tyranny, is not much of a man.

License in Alabama.

The Supreme Court of the United States has recently rendered a decision in the matter of the law enacted by the State of Alabama requiring locomotive engineers to be licensed. The court holds that the law is not a regulation of the inter-state commerce law, is constitutional, and the fee required is payment for service rendered, and not a means of raising revenue, nor a tax upon transportation. It looks as if the boys, in one State at least, would have to carry papers. Make the examination thorough and of a practical nature, and the men will pass. If this is done, anything that flies in cannot take engineers' places—unless the examiners could be bribed.

No man, or organization of men, ever built up a reputation, increased their pay, or added to their own self respect, at the expense of any other man, or organization of men. He who can only hope to go up after he has pulled some one else down, deserves to stay down—and he will. Deserve success and advancement. "By their fruits ye shall know them," is railroad law.

ASKED & ANSWERED.

(31) Button Sett, Topeka, Kan., asks:

What is the use of copper ferrules between flue and the front tube sheet? *A.*—To prevent the tubes from leaking; as a rule, all tubes are put in from the front end, and where the holes in sheet are as much larger as the thickness of ferrule the tubes are easily put through them.

(32) Throttle, Stewart, Iowa, asks:

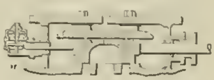
What advantage is claimed for the throttle arrangements used on the Rock Island road—and how is the dry pipe arranged? *A.*—The dry pipe is placed in the boiler as usual, but the end is open, the throttle valve being located in the T-pipe, or "nigger-head," in the smoke-box. The advantages claimed are that it is not necessary to go inside the boiler to grind in or examine the valve. All connections being outside, any derangement of the actuating levers can be doctored without blowing off steam.

(33) J. H., Buffalo, N. Y., writes:

Will you please advise, through your paper, a way to keep car wheels from sliding? I am conductor of a train on the "Belt Line" at Buffalo, and although but 60 pounds of air is carried, we are continually flattening wheels, and I cannot account for it, so I appeal to you to enlighten me. *A.*—It has been found that to obtain the best result from air-brakes the leverages should be so proportioned that 50 pounds of air in the brake cylinder will force the brake shoes against each pair of wheels with a force equal to the load carried by the wheels. Fifty pounds of air per square inch in a 10-inch cylinder gives about 4,000 pounds, and for an 8-inch cylinder, about 2,500. We should judge from the name of your road that its service was light, and, without knowing the exact conditions, would say that you have too much brake power for the loads carried. This can be avoided by carrying less pressure or decreasing the brake leverage.

(34) T. L., Alexandria, Va., writes:

I am running an engine 18x24 on passenger train with Richardson balance valves. I was asked what would you do in case you should break a valve yoke,



to cover the ports and not take chest cover off, and hold valve in place. My answer was, take relief cup out of chest and work valve in right position, and then put relief cup in chest again. Take oil plug out of top of chest, and have a bolt made to screw down on top of valve to hold it in place. Do you think I am right? *A.*—Our correspondent will see by the cut of Richardson balanced valve here shown, that screwing a bolt down the oil pipe hole would only bear against the balance plate, unless the bolts holding the same were loosened, in which case steam would blow around them, and a bolt cannot be made out on the road. Valve yokes are seldom broken so that the stem will not hold the valve; but in case it was so broken, we should think the simplest and quickest way would be to take out relief valve and push the valve to center of seat, disconnect the stem, push it up to valve, and cramp the gland to hold it there, then saw off a piece of the broom handle, or any other similar stick, and place it against valve, leaving it long enough to extend into the relief valve, to keep it in place, as shown at *a*. Should the relief valve be on cover we know of no better way than to take off cover and block. Where metallic packing is used the gland cannot be cramped, and a bracket, like Fig. 2, is often used. It is made of one-sixteenth iron, and is put on studs holding packing gland, and the key dropped through slot into valve rod connection.

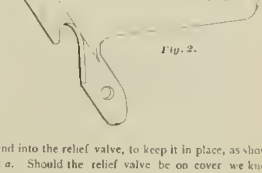


Fig. 2.

(35) T. E. W., Marquette, Mich., writes:

Can you tell me how to set a petticoat pipe properly—how it should be set for an engine which works on a hilly road, where you have to "knock it to her" to get to the top most of the time, and how it should be set if an engine runs on a comparatively level track, with long runs between stops? What is the principle governing the setting of the pipe? *A.*—The question is not an easy one to answer, as no set rule can be given of all, or even the general run of cases. This is one of those points that must be settled by the engineer, and in doing so he is required to bring into use his past experience. He must take into consideration the size of his cylinders, wheel, nozzles, fuel, the work to be done, the kind of boiler, shape of fire-box, etc. The office of the petticoat pipe is to conduct the exhaust directly to the center of stack, and to *control the source from which the gases are drawn.* In other words, the draft or petticoat pipe is to make the fire burn evenly all over the grates. If the fire-box is long and shallow this is harder to do than if it is short and deep. As a rule, the stack of a locomotive should be about the size of the diameter of cylinder, and the draft pipe about 75 per cent. of that size. The lower flues control the draft on the front of the fire, and the upper ones the back. By raising the bottom of pipe up you will give more room and more draft there, and by lowering the top of sleeve you will cause more draft through the top flues, and hence burn the fire harder at the door. Should you get your pipe too low at the bottom and too high at the top, yet in the right proportion, the side flues will suffer. Knowing nothing of your case, we should say set the top of pipe about four inches from the stack opening, and the bottom level with top of nozzles, and go out on road. Watch the fire; if it burns fast and dances merrily at a white heat near the flues, and tries to tear a hole there, it shows that there is too much draft through the lower flues; drop the pipe a little at a time, and watch; turn the scoop upside down in the open door while the engine is at work; this will deflect the air onto the fire, and allow you to see how it is burning. Very clean flues show fierce draft, and soot and ashes show little draft. Get the pipe to clean all flues nearly alike, and clean out the front end, and it will be all right. Actual experiment only will determine just where pipe belongs. It may be safely said that when the locomotive burns her fire evenly all over the box the petticoat pipe is in the right position and performing its functions.

(36) Embryo, Galveston, Tex., asks:

How should an engine be disconnected when a steam chest or cover has been broken on the road? Tell me just what to do, and why to do it. *A.*—Shut throttle and apply brakes, or call for them, and stop; send out flagmen, to keep other trains from running into you; disconnect the valve stem rod at rocker; take down the main rod; shove the piston to one end of cylinder, and cramp the gland enough to hold it, no need of blocking, as no pressure can get in cylinder to move it; take off nuts on such studs of steam chest as are left; take off cover, pieces of chest and valve; lay sheet rubber (if you have it) over the steam passages to chest, and a board on top; block up over this, using the valve or any other handy blocking, and put the cover, or pieces of it, or fish plates, over the studs, and clamp them down hard enough to prevent steam from blowing out of steam ways, load up your main rod, etc., take all the train you can handle, and proceed, leave enough of your train at the first siding to let you handle load easily on one side; report accident to your M. M. at first telegraph office.

IN THE ROUNDHOUSE AND REPAIR SHOP.

The new engines for the Brooklyn L roads have the DeLancey balanced valve.

* * *

Classification of wages has been abolished on the St. Louis and San Francisco road.

* * *

James Gillett, senior editor of the *National Car and Locomotive Builder*, died May 13.

* * *

Twenty inches is the narrowest gauge of road doing regular business in the United States.

* * *

Torpedoes should be carried in an iron box on back-board of cab—never in seat boxes or near the heat.

* * *

The Kings County Elevated road, of Brooklyn, is open for business on its Fulton street line.

A little tallow put on while the glass is hot will clean your gauge glass of lime and alkali deposits on the outside.

* * *

Many of the big lines of road are placing heavy orders for cars. Must expect to do a land-office business this fall.

* * *

The shops of the Central and Southern Pacific railroads, at Sacramento, Cal., employ 2,200 men, and will be enlarged this summer.

* * *

On consolidation locomotives it is quite a convenience if the blower is so arranged that it can be handled from the cab or the tank deck.

* * *

An old Turkish towel, cut in two lengthwise, beats waste for cleaning brass work in cab; you can get around hot cocks without burning the hands.

* * *

Engineers who are mean and overbearing to their firemen are the ones who would be mean and overbearing to all men under them, if promoted to any higher position.

* * *

If you were asked this question when being examined what would you answer? "If a flue should burst and let the water and steam all out of the boiler, how could you fill the boiler by the injector?"

* * *

Large orders for new cars are pouring into the shops; all of them are busy; the Indianapolis Car Company will build 2,000 gondola cars of 60,000 pounds capacity, for the Santa Fe. An exceptionally large order.

* * *

The cigar promised by our air pump man at Syracuse has been received at this office, inspected, and forwarded to the winner at Schreiber, Ont. Judging by the Flora del Cabbage odor, if it don't kill the guesser he will live forever.

* * *

The New York, New Haven & Hartford Railway will put in the scoop trough water tanks this summer. The troughs between the rails will be about four inches deep, fifteen inches wide, and 1,500 feet long. The engine tender is filled without stopping.

* * *

The new engines built by the B. & O. have the lower rail of frame bolted in. In taking down one pedestal brace, or binder, it is necessary to loosen and remove nuts from four bolts, and these are the same bolts that hold frame splices. Without having much experience in building locomotives we should call this a faulty design.

* * *

The baptismal name of the "Graphite Smear Grease," made by the Dixon Crucible Company, of Jersey City, will hereafter be "Graphite Pipe Joint Grease," the latter term better describing its use. Any of the stuff that the roundhouse boys have left over in packages, bearing the old name and label, will make just as good joints, however.

* * *

The locomotive builders who don't know any better than to place lifting injectors so low on boiler that they are below top of tank ought to ride on some of their cob-choppers. When the tank is full and the injector shut off, the runner has to shut off the water, or it wastes at the overflow. This kind of work takes time, calls the attention of the engineer from other and more important duties, disarranges the feed when once set, is an annoyance, a nuisance, and entirely unnecessary.

A recent issue of a railway paper says that the length of locomotive fire-boxes is only limited by the distance it is possible for a fireman to throw coal. The way we look at it, this limit has already been reached, and men who are daily breaking up and throwing from ten to twelve tons of coal per day into an eleven-foot fire-box ought to get better pay than they do.

* * *

Everybody knows plenty of enginemen who have risen to the high places of railroading. Some ex-locomotive engineers "get there" outside. Like his friend Colvin, of the same city, J. E. Lonergan, of Philadelphia, is turning to good account in the manufacture of locomotive and steam engine appliances, information gained by active duty at the throttle. Mr. Lonergan ran an engine for a number of years on the Central Pacific, under the late A. J. Stevens.

* * *

Our contributor, James Heron, of Buffalo, enclosing several subscriptions, writes us: "I see in your last issue an M. M. leads in getting subscribers. If all have sent the money who promised me they would subscribe, I think it would put me in the lead. The names here sent I got on your explanation of the injector. I propose to make as thorough a canvass of the large railroad shops in my neighborhood as a responsible foremanship will admit, and to take that banner from the M. M. before 1889."

* * *

Isn't it about time that that tramp that always lets off brakes when cars get away and do damage, who sets fire to all the bridges that burn who robs stations and fires the depot to cover the theft, who wrecks all the trains that strike misplaced switches or ties standing on their heads in cattle guards, etc., etc., was caught and hung? A few years ago all bridges that burned were set on fire by careless engineers, and by discharging the engineer who came over the bridge last the responsibility was fixed. Then there was the farmer whose stock had been killed—and not paid for—and then it got around to the tramp; and it is time he was caught. Like the insanity dodge for murderers, it is getting "too thin."

* * *

This is the season of the year when the boys take down the back boards and remove the storm glass from the front windows of their cabs, put up screens, and take the chinks out from around the boiler head. On many of the Western roads the boys put up awnings of oil cloth or canvas, tacking to top of cab, and sewing the bottom to a rod of iron made in the shape of a bail, and sprung into staples on side of cab, about even with the face, and arranged to tie up out of the way of roundhouse doors, etc. This keeps off sun, rain and cinders, and, if made the full length of cab, and without end pieces, they do not obstruct the view front or back, and are a great comfort.

* * *

The Erie Railroad has discharged the conductor and brakeman of the train that was run into while waiting for the signal to proceed at the approach of the Bergen tunnel recently. This has been the way of fixing the responsibility of railroad accidents, and it is a poor one. In the first place, the approach to this tunnel is on a curve—not protected by a distance signal. In the second place, there was but one brakeman on the train, and he had duties to perform there. The engineer of the following train was coming in too fast to stop in time, and the first train was held unexpectedly. The company itself, or its management, is to blame for not providing distance signals and a flagman on all trains.

THE LOCOMOTIVE ENGINEER.
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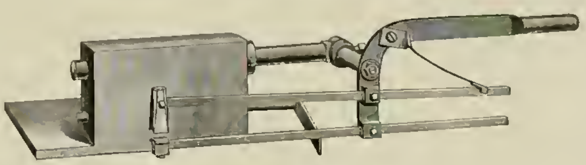
A Simple Flue Welder.

The accompanying cut represents a flue welder of simple construction that is the invention of Jno. N Buchanan, Batavia, N. Y.

The base of the machine is a simple cast-iron block with a large flaring bottom, and it is permanently placed on the right side of an ordinary blacksmith fire; it is not high enough to be in the way; through this block is a drill hole, that admits the shaft of the machine; this shaft carries a head, and this head a cross shaft, to which is fastened a lever that swings with the cross shaft and carries the long steel helve of the lower hammer; this helve can be lengthened or shortened by a set screw in the lower lug; the top helve is hung the same as the lower one, except that it is pivoted to move independent of the lever, the spring shown having a tendency to keep the two hammers apart.



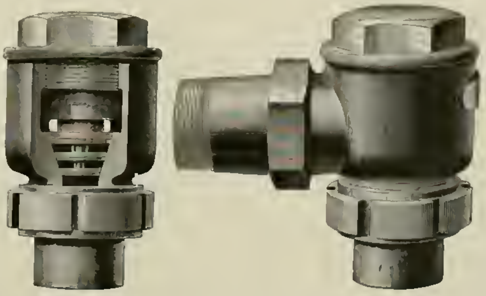
In use the flue and the end designed to be welded to it are placed in the fire, and not removed from it until welded; when hot enough, the lower hammer is inserted in the flue, and the helper holds it up by the lever; the safe end is held by coming in contact with the guide or stop shown below the shaft; the blacksmith strikes the top hammer with his ordinary striking hammer, revolving the flue at the same time. By this process the thin flue is not allowed to cool, as by other processes where it is taken from the fire.

The flue welded, the machine is thrown over by revolving the main shaft through block, and its levers are thus taken away from the fire. The set screw in the main shaft and the one in the block act as guides to bring the rig to the proper position for working. Without loosening a bolt, the whole rig can be pulled out of the block and put away. By using long helves very long pieces can be welded together.

The device is so simple and easily transported, as well as being cheap, that it can well be used where a machine could not be afforded For further information address the inventor, as above.

A New Check Valve.

The check valve shown on this page presents some very novel features, and, it would appear, many advantages. It is the invention of A. B. Glace, foreman of the Rockland, Cal., shops, and has been in use for two years on the Central and Southern Pacific Railways. These roads were troubled with checks sticking up on the desert divisions where the water is very bad and the present form of check was designed to avoid the trouble.



The cage is of the usual pattern, except that below the seat of the main valve there is a taper opening toward the water pipe, into which two extra valves fall and seat. These valves are guided by a round stem running into the main valve from the valve under it, and the bottom valve stem running into the middle valve. The main valve has wings working in the guide cavity in the cap.

The principal reason check valves stick up is that small pieces of foreign matter, scale, etc., get under them, and prevent their seating, but it is hardly possible that something should get under all three valves at once. The fact that the engineers all want this valve, and the company have adopted them, after two years' trial, is pretty good evidence that they do the work

J. E. Lonergan & Co., 211 Race street, Philadelphia, Pa, are the manufacturers.

Bad Signal Practice.

On several roads we have noticed that distance signals and semaphores are very often placed on the inside of curves, because they are easily seen by the engineer, but are entirely hid from the view of the man who turns them. All he knows is that he has moved the lever and the signal ought to be set; ropes, wires and rods often break, or bolts work loose, and the signal fails to turn, and the engineer might plunge ahead while the signal man thought he had him stopped Place the signal where the tender can see it, even if it is not so easy to see from the engine.

The new express engines of the Reading road are the heaviest passenger engines running into Philadelphia. They look like locomotives beside the Wooten fire-box mills—"bake-oven attachments," the boys call them. They are too modern for the Reading, and will probably be discarded.

Setting Eccentrics Before Wheels are Under Locomotive.

BY HIRAM R. JONES.

Some years ago I experimented on this problem, and constructed the machine shown in Fig. 1. The beveled openings rested on the journals, and were just far enough apart so that the two side pieces would reach from the center of one journal to the center of the other journal; this would give a side play to the whole machine nearly equal to the length of journal. The vertical straight edge welded to the cross-bar is in such a position that it may be set opposite either eccentric by sliding the machine sideways.

The beveled openings are accurately planed, and their centers coincide with the center of axle, and are a given distance from inside edge of straight edge. In use the crank-pin is placed on its center nearest the straight edge. The machine is so set that it will be level on top, which will bring the straight edge perpendicular. (See Fig. 7.) Now to set eccentric, subtract the sum of lap, lead and ½ diameter of eccentric from the distance straight edge is from center of axle; this will give distance to set ball of eccentric from straight edge. This rule will apply if the arms of the rocker are both the same length. If they are of unequal length, multiply the sum of the lap and lead by length of bottom arm, and divide by length of top arm, add this to ½ diameter of eccentric and proceed as in the first case.

Now, after this machine was made and used a time or two, a fellow machinist showed me a simple stick and string arrangement which accomplished the same result just as correctly, and can be made by any intelligent man in an hour.

I made one and laid aside the machine, which, of course, was rather humiliating after the thought and labor put on it.

The stick is constructed as follows: Take a piece of clear pine three or four feet long and 1½" square, Fig. 2. Lay off a line in the center at *A*; lay off another line at *B* as far from *A* as the sum of lap and lead multiplied by length of bottom rocker arm, and divided by length of upper arm. Set your dividers to ½ diameter of shaft, and with *A* as a center lay off lines *C* and *D*. Set dividers to ½ diameter of eccentric, and, with *B* as a center, lay off lines *E* and *F*. To use this rig set crank-pin on center as before. Place the stick—resting on a support of some kind—under the eccentric, with the face of stick projecting a little beyond side of eccentric, as shown in Fig. 3, which is a plan view. In this way it will allow the plumb lines shown in Fig. 4 (one of which is thrown over the axle and the other over the eccentric) to fall each side of the stick, and close to it at the points indicated by the dots in Fig. 3. Adjust the stick so that the lines *C* and *D*, Fig. 2, will coincide with the plumb lines *C* and *D* hanging over the axle. Then turn eccentric so that the plumb line hanging over it will correspond with the lines on stick at *E* and *F*.

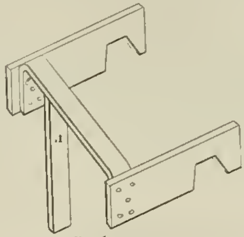


Fig. 1

There are one or two important points that should be noted. The crank pin is not necessarily on its center line when its center is level with center of axle. The crosshead pin is usually an inch or two above center line of axles, which would bring the crank-pin above said line on forward center, and below it on back center. This may be more fully understood by reference to Fig. 5, in which *A B* represents a center line through centers of axles. *C*, the center of crosshead pin at mid stroke; *D*, the center of main driving axle; *E*, the forward center of crank-pin, and *F*, back center of crank-pin. The height of *E* above center line may be obtained by multiplying height of crosshead pin above center line by ½ the length of stroke of crosshead, and dividing by length of main rod, or, simpler still, draw the lines in Fig. 5 on a board and measure the distance at *E* or *F* with a rule. Set crank this distance above center line of axles.

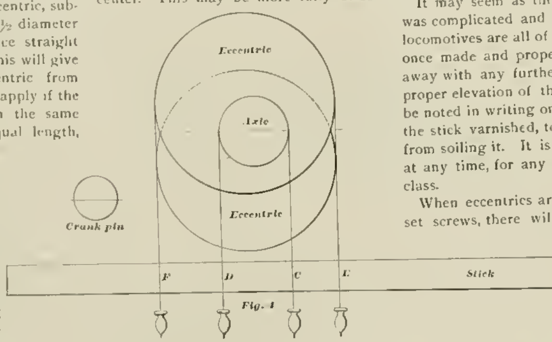


Fig. 4

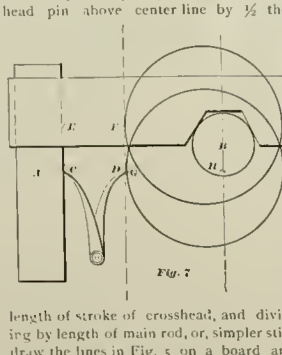


Fig. 7

Another thing: If the pin in bottom rocker arm is above center line of engine it will necessitate a new position for crank-pin in using this arrangement.

Referring to Fig. 6, let *A B* represent a line through center points of crank-pin (not center line of axles). *C*, center of main axle; *D*, bottom pins of rocker arm, and *G*, forward center of crank-pin.

Now for the sake of illustration, the elevation of the pin *D* above line *A B* is somewhat exaggerated. It will be seen that, in order to bring the eccentrics in their right positions, a line *E F* drawn across the front edge of eccentrics will be perpendicular to *C D*, and not *A B*. Now, as the line *E F* represents the direction taken by the plumb lines in Fig. 4, and the eccentrics must be set in that position, and the crank-pin *G* must be kept in the same relative position, we lower the point *G* to *I*, a point as much below *A B* as *H* on *C D* is above it. This distance may be obtained by drawing a diagram on a board, as before, and measuring with a rule.

It may seem as though this procedure was complicated and intricate, but when locomotives are all of one class, a stick once made and properly marked will do away with any further calculation. The proper elevation of the crank-pin should be noted in writing on the stick, and then the stick varnished, to keep dirty fingers from soiling it. It is then ready for use at any time, for any engine of the same class.

When eccentrics are only fastened with set screws, there will be no particular advantage in adopting this plan; but if they are to be keyed on, especially for a narrow gauge locomotive, where there is little room, it is a decided convenience.

From South America.

John J. English, an experienced and well-known locomotive mechanic, has recently returned from a two years' sojourn in South America, where he has had charge of the long but successful trials of the Baldwin locomotives in competition with the English locomotives in the Argentine Republic and Uraguay. Mr. English says that the Atlantic coast countries of South America are very poor places for railroad men to go to; many English and native engineers are running down there for $35 per month, and $4 per day being the highest wages paid, even on the Pacific side—this being the exception rather than the rule.

One road, in the Argentine Republic, over 1,000 miles in extent, uses the worst water on earth, it being necessary to replace all flues in a few weeks, the boilers being thoroughly washed every trip.

Copper fire-boxes and stay bolts are used in all makes of locomotives.

Mechanics in charge are largely English, and American manufacturers have to combat their prejudices, one of the most stubhorn being their utter lack of faith in the strength, adaptability or safety of cast-iron centers for driving wheels. They declare that they won't and can't stand the work, regardless of the fact that the hardest service known is being daily ground out of thousands of locomotives in the United States, all riding on cast-iron drivers.

Mr. English has great faith in the staying qualities of the American locomotive and believes that their peculiar characteristics will make them the cheapest, easiest repaired, and best working engines in South America, and that they will eventually supersede all others. He expects to return to South America soon with another installment of Baldwin engines.

Injector Practice.

BY PRIMER.

The more we know about the notions of a woman, the easier it is to get along with her—in this respect women are like injectors. The less we know of a cranky woman, the less we know what to do to get her to work—same as an injector. You can reason with a woman—same as an injector (and it will do just as much good). You can know so much about a woman or an injector that either one dare not "act up," and if they do they are easily cooled off; it all depends on knowing what to do and when to do it.

If your injector breaks easily on the road, look out for your strainers. If it breaks when you throw the engine over, or in stopping suddenly, look to the dry pipe inside the boiler; it may be disconnected, or the "fountain" or "duck's-nest," may have no dry pipe, and the water enters the steam pipe and breaks the current.

If it primes slow and poorly, look for leaks in suction pipe below injector, that let the air leak in, and prevent the formation of a vacuum. If your primer leaks don't report check ground in or *vice versa*. If you primer is leaking it will not prevent the quick formation of a starting jet; if the check leaks it will. If a Monitor primer leaks it will not stop blowing at overflow if you screw down the heater cock; if the check or ram leaks it will stop and go back to the tank; if an independent primer "Little Giant," pull regulating lever back; this will put combining tube against delivery tube, and send steam and water from check to tank, if steam still blows at overflow grind in the primer.

If your Hancock Inspirator blows so at overflow that it won't prime, shut off throttle next to boiler; if blowing stops, grind in operating valve under main cap at steam connection; if it still blows, look to the check.

Work your injector so as to just supply the boiler; do not work it full head with a light train till you have the boiler full, then shut off.

When you lessen the quantity of water by the lazy cock or tube regulator, lessen the quantity of steam at the same time.

Once a week shut off steam, close water supply and overflow, and put in a few tablespoonfuls of black oil and let it cook there by giving a little steam, it will remove scale, oil all the internal screws and soak the fibrous packing so that all cocks and plugs will handle easily.

Sometimes roundhouse men or others doing work in cabs shut off the globe valves next to the boiler, leaving them open

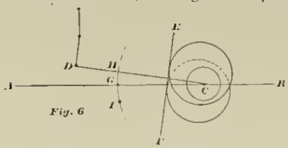


Fig. 6

just enough to prime the injector, but without volume of steam enough to make them work.

Often the loose ball-valve on steam ram comes off by its nut working loose, and it drops into the water space below; steam will blow full head at the overflow, and will not stop when ram is screwed clear in. If you are on the road, and it is important that you get your train in, don't try to fix it then; shut off steam valve next boiler, get left hand instrument to work, and then take off the valve-stem box, cool the injector with a pail of water, and fish out valve and nut, replace and go ahead.

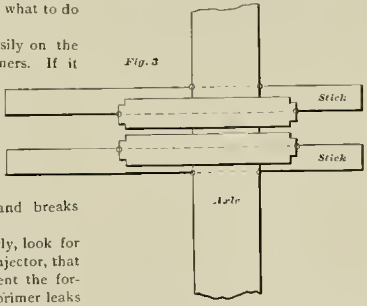


Fig. 3

In extremely cold weather injectors will often refuse to work because the manhole cover on tank has frozen solid and a vacuum is formed above the water in tender; put on your heater for a few minutes and break cover loose.

Use left hand injector daily, to insure its being kept in working order. If it is a non-lifter let the water run through it for a few minutes to cool it off and secure a current, open steam valve very slowly and just enough to notice that water is being

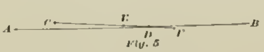


Fig. 5

thrown from overflow pipe a little faster than it will run, then open steam valve full and quickly, throttling down steam

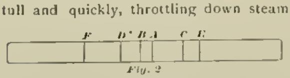


Fig. 2

and water afterward. Try to use your feed water arrangement when the engine is at work and the fire bright; avoid "cooling off" when standing still with water, unless to keep up level in boiler.

In starting out on a run, have water enough in the boiler to allow you to run without using pump or injector until fire is at full heat.

Don't try to see how hard you can shut primer and steam valve—shut is shut and it can't be no shutter.

Don't pound an injector for any fault—it will do no good.

If a check sticks up, tap the top of cage lightly with a soft hammer or a piece of wood—not the coal pick.

If tapping it smartly will not bring it to its seat, a pail of cold water poured onto it will often do so.

Don't expect a ¾ pipe to carry off the overflow from a big injector—make the waste pipe ¾ the size of feed.

If there are many crooks and turns in branch pipe, use a size larger pipe than the fittings.

Don't expect a No. 7 injector to go into an engine with No. 6 pipe, check and feed pipe, and do No. 7 work.

Oiling Bearings.

There are bearings and bearings. One has got in the habit of being oiled every trip, from two to ten times, and will get hot if not attended to, and the other runs several months, making many thousand miles, and don't seem to care much whether it gets oiled or not. One is on the engine and was raised a pet, the other is on the tender and has been neglected. Just why a bearing on an engine truck needs oiling every two hours, while the same sized bearing, under the tank, carrying fully as heavy a load does not need oil oftener than every two months, is a question that does not seem to have been probed into very deeply.

The writer is of the opinion that the engine truck gets too much oil and the tank too little.

Oiling a locomotive is, as a rule, done more by habit than by any study of the requirements of the service. Every drop of oil that runs off and away from a bearing is wasted; all the oil used that leaks out of boxes or cups after the run is over is wasted. Study the work your bearings have to do, and experiment on how much oil you can use and not waste it, yet have enough. One of our big railroads investigated the oil business two years ago, and found a difference of over 100 per cent. in oil used by different men. They took the ten most economical records and averaged them, and then limited the amount of oil served to engines to that amount. There was a kick, but the boys soon learned to do with less oil, and all had enough, while some who studied hardest on the problem had a little left over to sell. The officers of the company claim that the limited rule saved the company over $50,000 last year. All problems of economy on a locomotive deserve the careful study of every engineman, whether he believes in them or not; the day is fast coming when a man's record will be of value to him.

The extension front, straight stack and brick arch have evidently come to stay. The majority of the master mechanics are in favor of them.

Starting Non-Lifters.

Non lifting injectors on locomotives are usually large sizes, from 7 to 12, and have large connections. The globe valve used as a throttle is usually a large one, and it is very often well-nigh impossible to open this just a little, while the engine is running in order to catch water and produce a current before giving it a full head of steam to start the thing to working. Non-lifters are usually on the left hand side, and seldom used unless wanted badly, and in opening the valve the current is often broken several times, and once broken a non-lifter is surprisingly easy going about starting the stream again. If globe valves used for throttles on this class of injectors had a plug below the valve seat that nearly filed the hole, when first opened they could only give the injector a very small dose of steam, and, we believe, would start easier and with more certainty.

How to Make Fast Time.

Conductor William T. Jordan, of the New York Providence and Boston Railroad, who has charge of the Shore Line train from New London, due in this city at 5:25 A. M., made some fast running on Friday morning. The mail train drawn by locomotive No. 39, S. D Babcock, arrived at Wickford Junction fifteen minutes late, leaving there at 5 06 A.M., instead of 4:48 o'clock. In spite of this delay, the train rolled into the Providence depot at exactly 5 28 A M. only three minutes behind schedule time, having made the run from Wickford Junction to Providence, nineteen and a half miles, in twenty-two minutes.—*Providence Journal.*

Wonder what that useless luxury, called an engineer, was doing all the time "Conductor" Jordan and the 39 were making their fast run. According to some authorities, the mere fact that a slick conductor is back in the chair car, with his eagle eye on the rail, will just make a locomotive hum.

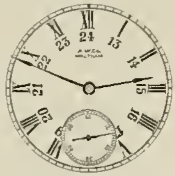
Insure Before You Burn Out.

We recently saw a note written by an engineer to his M M. that read: "I have already been on duty 18 hours. If I go out this trip I cannot reach a terminal station until I have been on duty over 30 hours. This I cannot do and keep awake. I would rather be discharged for refusing to go out, than for having an accident for want of sleep—do not send for me until I have had ten hours of rest; I shall not go." This is the right stand to take—an ounce of prevention is worth a pound of cure. The officials of the companies hold men responsible for everything that happens on the road, regardless of the hours of rest he may have had.

The 24-Hour System.

Slowly but surely the 24-hour system of computing time is gaining ground in railroad circles. It is a reform, a safeguard, and all such reforms have to fight their way, but, like truth, they usually come out on top.

People opposed the establishment of standard time, and kept all kinds of time in the same house for years, but they would not now go back to the catch as-catch can time of the '70s; and we confidently believe that, in ten years, railroad men will wonder why they risked the old A. M. and P. M. system as long as they did.



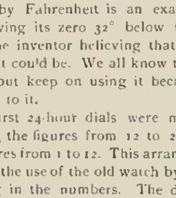
Several roads now use the 24-hour system, and like it; among these are the Union Pacific and the Canadian Pacific, two of the largest trans-continental lines.

When changes are made it is customary to adhere to the first form of the new device, and these when once established, are often adhered to, even when they are known to be wrong. The thermometer invented by Fahrenheit is an example of this, having its zero 32° below freezing point, the inventor believing that was as cold as it could be. We all know that it is wrong, but keep on using it because we are used to it.

The first 24-hour dials were made by marking the figures from 12 to 24 under the figures from 1 to 12. This arrangement allowed the use of the old watch by merely marking in the numbers. The dial here shown made in this way is the one in common use, and was kindly furnished us by Robbins & Appleton, New York agents for the Waltham Watch Company. The device is crude,and opens as big a field for blunders as the A. M. and P. M. system.

H F. Colvin, of Philadelphia, a man of wide experience as a locomotive engineer, has been for years an advocate of the 24-hour system, and some years ago ordered a watch made, on which he had taken a hand at the details.

A few real 24-hour watches are made, but from habit, or lack of thought, the 1 and 24 are at the top.



Mr. Colvin's watch, as here shown, has the 12 at noon, 24 at midnight and the 6 at daylight, so that the hour hand always represents the sun. From 6 to 18 o'clock it is daylight and from 18 to 6 it is night. There can be no possibility of a mistake in looking at the watch—if the hour hand is in the lower half of dial the sun is in China, New Zealand or Australia, and it is night; if it is in the upper half it is on our side, and it is daylight.

The idea is simpler to teach, simpler to understand, and on its face looks sensible and reasonable. It is just as easy to commence right as it is to commence wrong. Is not Mr. Colvin's idea right?

Air Brake Practice.

BY J. E. PHELAN

THIRD PAPER.

When an engine is coupled to an air brake train, maximum pressure should be on hand with which to work or release brakes if train is on continuous trip. It should always be known that it requires equal or greater pressure to release brakes, than pressure on hand in train pipe and auxiliaries when brakes are applied. If engine is coupled to a train where all pipes and auxiliary reservoirs are empty, the engineer must know that enough air must be pumped to supply pipes and auxiliary reservoirs under all cars with uniform pressure, before brakes will do effective work Because a train man asks for trial of brakes immediately after coupling engine to train, is no reason why air should be wasted in useless trials before uniform pressure is supplied to engine and all cars alike, and engineer's brake valve held in proper position to provide greater pressure in main reservoir than that supplied to train at time of setting brakes. After coupling to an empty train, supply of air expands back into train pipe and auxiliaries, and pressure reduces accordingly as indicated by air gauge. When pressure stops reducing and gauge indicator commences climbing again toward maximum pressure even though it be but 50 lbs., brakes can be tried and can be depended on usually as indicating proper condition. It is always desirable to have maximum pressure before starting on a trip, and then brakes can be relied on without doubt, if properly inspected.

Knowing that an air pump with a cylinder but 8 in x 10 in., or an air cylinder 6 in x 15 in., must pump air into a main air reservoir usually 25 in. x 28 in. or 25 in. x 32 in., and this main reservoir in turn must supply from 6 to 12 passenger cars, having each auxiliary reservoirs 11¾ in x 30 in., it can be recognized, without further figuring, that the source of supply and the economical handling of the supply is a most important point for study and practice.

This study and practice should lead to maintaining the proper or maximum supply of air pressure at all times, and the use of this supply in such a way that effective work shall *always* result without discomfort to passengers; and positively without injury to rolling-stock or freight or live stock in transit on freight trains.

To insure good air brake practice it must be known that every time brakes are applied, air flows from auxiliaries into brake cylinders 8 in. or 10 in x 14 in. usually, and when brakes are released air escapes from cylinders into atmosphere, and is wasted; and auxiliaries are again recharged from main reservoir and air pump, through the medium and automatic action of triple valves attached to each auxiliary.

For brakes to release promptly, the reserving of greater pressure in main reservoir is provided for and insured by proper handling of engineer's brake valve, as explained in former paper. There is in use an improved air brake gauge. Practically a double gauge in one casing, with one pipe leading to pipe connection with main reservoir, and second pipe leading to connection with main air pipe. Each pipe acts on separate indicators on face of gauge and while one records the pressure on main air pipe and auxiliaries, the other records pressure in main reservoir. It is most novel and important, in recording variations of pressure in accordance with the practice in force, and forcibly shows whether practice is skillful or awkward.

Another important assistant in good practice, but condemned by many engineers, because they do not know better, is the air pump regulator or governor, that works automatically in preventing air pressure running higher than maximum allowed.

Running on the road with maximum pressure and all appliances in good order, the main object is to do most effective work with least quantity of air.

The engineers who do the most effective and smoothest work with the least quantity of air are the best air brake men.

After accomplishing effective work with economy of air supply, the next consideration should be to have brakes release without discomfort to passengers from the back-lurch, so common on many roads, by having brakes remain set and not being released until after train has stopped. To avoid this back-lurch requires accurate judgment in releasing brakes while train is in motion, so that *brakes will all be released at the moment stop is made*, thus avoiding rigid stopping of trucks while body of car has gone forward with motion of engine, causing the disagreeable jerk when returning to proper position on trucks. Engineers should so handle brakes that trucks will move to accommodate body of cars, and not have body of cars move to accommodate rigid position of trucks held in such position because brakes are not released in time.

Putting Water on Hot Pins.

There is probably no other cause of delay so annoying to engineers as hot pins. They feel a certain personal responsibility for them, and a desire to get over the road with as little delay as possible, that can be laid to the engine, makes most runners extra anxious to not have hot pins, or, if he does have them, to be able to get rid of them as soon as possible.

For this reason some runners put water on hot pins to cool them off, and for the very same reason many other runners will not put on water to cool them off; claiming that it makes the brasses spring and the pin rough.

Another man will put water on a pin if he has the rod down and the brass away, but not while it is on the pin.

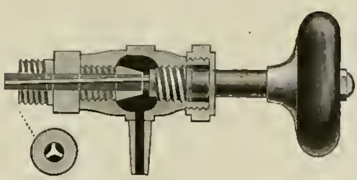
This is one of those points where an engineer will be guided and his belief settled by his own experience.

There is no doubt that it makes considerable difference whether a pin is made of steel or of case-hardened iron. As a rule, we do not think it good practice to use water on very hot pins; they can be cooled off often by slacking off key and using plenty of tallow or other heavy oil.

If a brass commences to throw babbitt do not stop; keep running until it is all out, then take out cup and clean oil hole if it is foul, and use a heavy feed of oil or, if it is thought best to take down the brass, scrape off the babbitt and fill the groove with soap, plumbago or with a strip of leather. It is almost impossible to throw babbitt as long as the bearing is getting oil. As soon as babbitt is gone, look to your feed.

Improved Gauge Cock.

The cut shown herewith gives a good interior view of a new gauge cock brought



out by Shaw & O'Toole, Girardville, Pa. As will be seen, the valve seat is immediately over the nipple, and is formed by the part that screws into the boiler being extended into body of cock, to meet the bronze valve. To the center of the valve is rigidly attached a three-cornered rod extending into the boiler. It will be seen that at every opening of the cock this rod is revolved, thus cleaning out the hole. The actuating screw is large, and is ahead of the packing, little of the latter being necessary.

The main part of cock and the piece that is screwed to the boiler can be taken apart, so that when repairing the seat it can be seen and got at; it is also a great improvement when threads are stripped or broken, as a new piece is much easier and cheaper made than an entire body. The cock is heavy and well made and finished.

Engineers Wanted.

A few years ago an engineer had fewer responsibilities, but took more risk. He had no air brake to take care of, but he might get killed for the want of one. If he wanted to stop bad he whistled "down brakes," put her in the "breechin," and waited for the brakesmen to get in their work. Now every improvement puts more cares on his head and hand. He has the care of and handles a complicated brake, he is responsible for the observance of a thousand signals, the heat of the cars has been asked from his supply, and he will soon have another little engine and a dynamo to care for; yet he is only a laborer in a soft snap; anybody can take his place; you can teach men to run locomotives in school (?) He is getting pay that belongs to the conductor, because the conductor is responsible (for the tickets). These brazen beggars have the impudence to ask for three or four dollars a day while they have got pie in their lunch pails. Some people want the earth—the engineers are some people.

What this country wants is a new set of ready-made engineers. They might not run the trains with surprising regularity, but they could be depended to keep down the excess population.

Will-o'-the-Wisps.

Few are the car hands that can't look back with a hearty laugh to some comical experience of his own or his comrades, where someone has mistaken something else for another train. The moon is sure to fool someone every time she gets full, which she does with painful regularity. Men have stopped before now and sent out a flag against a star that was peeping over the horizon right between the rails; and all of us have laughed over the Pennsylvania Dutchman who was running second section of a train, and coming suddenly upon a pair of red lights, came right down to three miles an hour, and followed a canal boat till daylight.

A few years ago the writer was firing for a genius who was sure to find all the will-o'-the-wisps that were out. One night we doubled an elbow rather suddenly and a bright headlight shone in our faces, looking as if it was not more than a quarter of a mile away. The old man jumped to his feet and exclaimed: "There! Half a minnit more and we'd a got 'em on this curve!" and as he spoke he aimed the starting bar at the caboose and commenced to choke our old hog to help out the air that was getting in its work from the start. At every hump of our engine he would let out an unearthly shriek for brakes, that would freeze the spine of a professional murderer. Said he: "Sliver, my boy, it was a close call; run down there with a red lamp, and tell them to get back to that siding quick; it's that 11 o'clock extra." The writer started out with Aladdin's lamp—and it needed rubbing—and no minister plenipotentiary ever felt more importance with the orders he bore; but just as we got about half way to the headlight, seemingly, it disappeared, looking for all the world just as though it had backed around a curve. From past experience ye scribbler had learned that it was not much use to chase a locomotive, especially if she had any great odds on the start; so there was a halt, and before you could catch your breath, a signal was blown recalling the flag. The entire crew was on the engine till we reached the next side track, but there was no train there. Suddenly the bright flash was seen again, and a vote taken declared that they were still backing up and now had several miles the start of us, as they were not dead ahead. Then my bold engineer tried to catch them, but as often as we seemed to get within signaling distance, the headlight would disappear, and about the time any of us had declared that they had blown it out it would show up again. Two miles from the terminal station was a new blast furnace, and it had been blown in that day and the gas check, or whatever they called the valve on top, that shows such a white blaze when they are charging the furnace, was what we had been chasing. It was too good to keep, bad as the old man wanted to preserve it, and the next trip the engineer got a message from the superintendent to send in accident report of his collision with the steel works.

Something About Lead.

The average man who tackles a job of firing soft coal for the first time, dreads it, and if he has never fired anything before he is apt to be a little nervous as to his ability to "keep her biling."

From an experience of several years with the freshmen class of these students, and having been one himself, the writer can think of no better way of illustrating the actions of the new fireman than to show him as a man under contract to empty the tank of coal into space through the stack as quickly as possible. No matter what happens, the scoop is his only remedy; he is not used to the noise, and can't understand the engineer, and if he so much as looks at the stoker, he jumps for the scoop; if she pops, he gives her more coal to keep her hot; if her steam gauge begins to get tired, he shovels as long as there is room between the grates and the crown sheet, unless the engineer stops him. One case came under our notice, that shows what an important thing 'lead' is to a new fireman. The cadet who wanted to be an engineer bad enough to fire several years first, went out with an old-time engineer, who could not keep him from shoveling coal and have any time left to run his engine, so he let him work and did the best he could with his train. They arrived at the other end of the division several hours late for the want of wind, and the engineer concluded to illustrate to the fireman what he had failed to make clear by word of mouth.

"Mike," said he "take that scoop into the blacksmith shop, and tell the boss blacksmith to give her less lead; tell him to take out a good bit."

The engineer's face was as calm as a summer sea, and looked as if it might have been a masterpiece of Michael Angelo moulded in shoemaker's wax.

Mike took the shovel into the shop and repeated his order. The boss Vulcan found out whose engine it was for, and resolved to have a little fun with the joking engineer, so he took the No. 5 scoop and cut off about four inches from the edge. He ought to have changed its number to 1½.

Mike carried it back and asked the engineer how it would suit.

"All right," said the runner, "that was the trouble; she'll steam to-night."

She did. Mike could not get more coal into the fire-box than she would burn, work as hard as he would, and after a few trips he got weak enough to tumble to the fact that a little judgment mixed with the coal was a good thing for a fire, and that, when he knew how, it was easy work to keep an engine hot with a scoop having any amount of 'lead,' provided he did not work it in the corner all the time.

Correspondence

Was This the Trouble?

Editor The Locomotive Engineer:

In reply to the air pump conundrum of W. F. R., of Syracuse, N. Y., I think he found that the nut on lower end of main steam valve became loose, thereby allowing the lower valve to drop down, thus preventing the pump from working.

If my solution is correct W. F. R. can send his "Havana" to

Laramie City, Wyo. Ter. F. E. R.

Is This Guess Right?

Editor The Locomotive Engineer

In reply to W. F. R., of Syracuse, "Conundrum" on Air Pumps in June issue, would say that the button on lower end of reversing valve stem had either worn or broken off, thus failing to pull the reversing valve down and admit steam to top of reversing piston. Your paper is more interesting than a novel, and I can hardly take time to eat until the paper has been read through. I wish you unlimited success.

Bennington, Vt. C. S. B.

The Cushing Reverse Lever.

Editor The Locomotive Engineer

In your May issue you show up a new, and I should think, excellent, reverse lever, the invention of Master Mechanic Cushing; something of the kind is needed. But I never see anything on a locomotive but I try and think of some improvement on it, and I want to suggest one to Mr. Cushing. Instead of the latch tipping the worm out of gear with the worm wheel, I think it would be better to arrange to lift the whole gear out of contact with the quadrant. This could be easily done, and I should think would be better. As now arranged, the gears revolve while lever is being moved by the latch, and are liable to catch clothing or dirt enough to clog them, and when in use at about the right place for service, the wear comes all in one spot on gear and worm wheel. If they could be lifted out they would seldom get back into the same place, and I think would wear longer and keep stiller. H. D. Doyle.

Denver, Colo.

Worse and More of Them.

Editor The Locomotive Engineer:

I guess the man who wrote that item about the taper plug blow-off cock has not been run by an engine with those old fashioned taper plug cylinder cocks as I have. There is but one blow-off cock (thank Heaving), but there are four of those low lying, dirty plugs beneath the cylinders; as a rule three of them can be got shut at once, but four very seldom. If you try to fix them yourself you get one to shut, but his partner on the other side will open, and you will be sure to get one loose in the cylinder and get the whole system into contortions. This 4-ply nuisance always leaks somewhere, they get full of dirt, the jamb-nuts work loose, they get out of line, if you strike a cow they get on a dead-center and won't open, and they get their backs up and won't shut.

Good, reliable, easily worked and tightly closing cylinder cocks are needed, and needed badly. They do not need inventing; there are a dozen valve cocks in use that are reliable, whose actuating levers do not tend to twist the cock in the cylinder, and that do not present three times as much surface in contact to move every time they are used as there is any need of. Locomotive builders, master mechanics and traveling engineers will begin to study up these things sometime from the road, and not from the shop, and when they do they will commence under the cylinders if they heed the kick of "Soo."

Minneapolis, Minn.

The Black Smoke Nuisance.

Editor The Locomotive Engineer:

The above-mentioned nuisance, if indeed it can be called so, is a question of great import with some of our leading officials A large number of roads require their passenger firemen to burn the smoke to as great an extent as possible, especially before coming into stations. There is one official of high standing that I know, who got the idea into his head that making black smoke was all foolishness. Any way, to think with him was to act, so he caused the M. M to post an order to the effect that all locomotive enginemen were to avoid making black smoke, and especially on coming into station. All who disobeyed the order were to be suspended. He made no distinction between freight or passenger men. The passenger engines did very well with the light firing required, but when it came to the freight engines, with thirty loads behind them, working the lever half way down in the corner, throttle out to the chain, injector working full, Mr. Official's orders, ideas and all went up in black smoke, and they never came down. But as every intelligent engineer and fireman well knows, this fogging the country with smoke, as too many of our firemen try to do at all times, is useless, and a waste of fuel. Let them study their work and try to learn something of the qualities of fuel and the science of combustion, and there will be a marked improvement in our firemen; and a great many of our engineers are in the same path—men who are content if they know enough to pull a train over the road and draw their pay, who could not tell why the crossheads wear on the upper guides in going ahead, or how to set a slipped eccentric, and in a breakdown would stay on the spot till some one pulled them in. We have too many such men running engines to-day. I hope the day is not far away when a man will have to be a first-class fireman before he is promoted, and will have to pass a thorough, practical examination (with all red-tape business left out) before being put in charge of an engine. I am not in favor of licenses given by State officials, as there are too many paper engineers, who never fired a day in their life, who would be turned loose to prey on the skilled men who have worked for the positions they hold.

WM. R. CLINE.

McArthur, O.

Helplessness.

Editor The Locomotive Engineer:

I can assure you your paper supplies a want among locomotive drivers, firemen and iron workers in general. Heretofore we have had no medium through which to voice our complaints or seek information, and I, in conjunction with a large number of my friends, wish your paper every success.

The division I am employed on can boast of a class of drivers second to none in America for intelligence and capability; not so on many other roads, where I have seen drivers who were so ignorant of what they were handling that it made my hair stand on end. Now, I will give you an instance which will, I think, go far towards proving my former argument correct. Some years ago, our road here, being in course of construction, my duty consisted in looking after the water supply. I was on the passenger express one day, when, coming to a station, we found the main line blocked by a wood train, the engine being dead. The driver of the express pulled him on to a side track and left him. My business keeping me at that station, I got off and went to inquire the cause of the trouble. The driver told me his pump had given out, water got low in boiler, safety plug, of course, blew out, as it should, and extinguished the fire. He had wired, he said, for another engine, but could get none, as there were no spare engines Now I went to work and took off his check valve, and found a piece of scale or iron jammed in the seat, which I picked off; made connections, went to a forge a short distance off, and had a taper plug made, which I drove into brass plug in boiler and got up steam, and he proceeded with his train. This was all accomplished in one hour and a half. Now I maintain that had he the requisite skill he could have managed all this himself, which goes to prove my assertion. I believe in the old saying that *when we learn a little, we find how little we do know.*

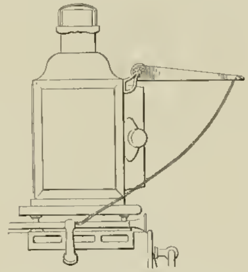
MECHANIC.

Quebec, Ont.

Improved Headlight.

Editor The Locomotive Engineer:

Sometime ago your paper told of the idea of blindfolding locomotives, but I think I have a better scheme. On our road we use the headlight to signal by; as long as it shows up at night it is on the main line; if we take a siding for another train as soon as we clear we cover the headlight, and have used a curtain inside, hung on a rod; but this made us go outside to cover it, and in windy weather the light was often blown out while monkeying with the shade. I had a light cover made for my headlight like sketch; it is hung from the top on a shaft that carries a stiff coil spring, always tending to keep it open; to one corner I attach a cord, as shown, that comes to the cab through the handrail. I can shut the "winker," as my fire-boy calls it, from my seat, and have a



hook to hold it shut; it keeps the glass clean, and the inside being painted white, it throws a brighter light on the track, and avoids another disagreeable thing—all runners know that when smoke and steam is driven ahead of the engine how the headlight will light it up and shadow the track. I find this reflector keeps the rays of light from getting very high till too far ahead to catch the floating steam.

Chicago, Ill. JAS. FENTON.

Boring Flues—A Cold-Handled Auger.

Editor The Locomotive Engineer:

I am back with the Kid in Texas, and I have recently learned something about flue boring and flue augers. A man that hasn't got sense enough to know that he can't read French until he has spent his good money for a French book is not very bright, but I am about in that fix. Of all the hard jobs that fall to a fireman's lot, I have found that keeping the flues clean where soft coal is used to be the worst, but the Kid has taught me a little flue science, and I find it was myself more than the work.

I had read advertisements of flue cleaners of one kind and another until I came to the conclusion that if, by spending a little money for one, I could save exertion, I would do so, and I sent for one. It is here now, bright and new, with crooked wings enough to fly through a flue, and back out itself, but it has as yet been uninitiated. I showed it to the Kid the day I got it, and he looked sorry for me, and said: "I make it a point to let a fireman do his work as he likes best just as long as he gets it done; I don't like to claim my way is best at all, but I have noticed for some time that you have worked to a disadvantage in keeping your flues clean—it's half a day's work, and hard, dirty work, too, every round trip. You wait till the engine is cold, and then open front end, move the petticoat pipe and bore and punch till you are tired out, and then readjust, and go home mad enough to fight a bulldog.

"Now let's study this thing a minute; a locomotive has a forced draft, and anything that don't stick in a flue goes through in a hurry, and it leaves the flue clean; you never saw soot burned into the inside of a flue in a locomotive like you do in a natural draft, stationary boiler, and for this reason your fancy scraper is of no use. The reason locomotive flues stop up is that a large cinder or clinker gets stuck in the fire-box end of the flue, and shuts off most of the draft in that flue, and what other dirt gets in stays, as there is not draft enough to pull it out. If the flue is left long enough, it will stop up solid from the other end, and 'bake in' and it is a hard job to get it out. What you want to do is to get rid of the clinker before it lets the flue get full of cinders. This being the case, you want to clean the flues every trip over the division. You want to avoid work—then clean your flues from the firebox end, and avoid opening the front door and elevating draft pipe. You can't work your flue auger when the tank is full of coal; do so when it is nearly empty.

"Now you get a pair of flue augers, one long and one short; use the short one every trip to punch out clinkers, and the long one about once a week to probe flues that will get full. When I was firing, I got a length of ¾ pipe and had a two-foot auger made to screw onto one end, on the other end I put a T and two six-inch pieces for a handle; one of these I stopped up at the end, and left the other open. I used it through the fire-box when we were dropping down long hills, and when it got hot I used to pour it full of water through the handle, changing water often enough to keep it cool. The pipe is stiffer than a rod, and you are surer of your aim when the engine is running. By doing a little of this work every trip, it will not get the best of you, as it does now."

The difference between this young engineer and myself is that he does nothing without studying on it, and I have been doing my work as others have done it, without thinking. I have followed his idea about keeping flues clean and it is not half so hard as the old way, and I do this much work while I am under pay, and not while I should be taking needed rest. I believe that, by thinking about the details of my business, I can save myself lots of exertion and the company many dollars. I shall think.

TEXAS.

Galveston, Tex.

Naming Engines.

Editor The Locomotive Engineer:

Some time ago you published an item on engine names, and I just came to the conclusion to give you a little scrap of my 30-odd years' experience on a foot-plate. In the earlier days of railroading in the United States, all engines were named and not numbered, but when the roads came to own a hundred or more locomotives the numbers were introduced more to classify the engines than anything else, as clerks, etc., could not remember just what kind of a scrap each one was. I also remember when passenger trains were all named and not numbered. I found that running an engine named after any of the general officers was easier than running one named for a town or anything else. If Gideon Gibbins is general manager of a road, and I am running a mill with "Col. Gideon Gibbins" in gold leaf on each side of her cab, I need not fear that she will need repairs very bad, or have a bad fuel record, or want for a soft run when Col. Gid. goes over the road seeking whom he may devour. Naming for towns or places does not always pay, either; I was out West a few years ago, and saw an irate plug-puller chasing a Hebrew drummer about a depot platform, because the H. d. had asked if his engine's name indicated her record for speed. She was named "Ten Mile."

Elmira, N. Y. ELMIRA.

The Extra Man.

Editor The Locomotive Engineer

Of all things firemen dislike, being on the extra list takes the lead. Now, while I don't blame a fellow for wanting a regular engine—one he can take care of and feel proud to be on—still, as a man serving his time as fireman is only learning to be a runner, there are chances for the extra man to learn, which the regular man seldom has.

To learn as much as possible, and to perfect himself, should be the aim of all; and right on the extra list is a good place for the pushing, energetic man.

To the boys who are thus situated, I would say: Don't be discouraged, but every time you go out see if you can't learn something; not only to be a better fireman, but something that will be of use when you step over to the right hand side. Avoid the faults and practice the good qualities of those you have been with. A man who is thoroughly in earnest will strive to please those with whom he works, and at the same time will study how to do work to the best advantage. If you are out with a man who likes to carry water so high it keeps slopping out of the stack, just note if he gets any more work out of the engine than the man who runs with a flutter in top gauge, or if he is any easier on the fireman.

If you strike a man who runs forty miles an hour and then has to wait for time at sidings, just think it over and see if he gets over the road any quicker than the man who uses the card time between stations. See if there is any difference in the amount of coal and water used, or if your back aches as badly with one as the other.

You will get on with some to whom it always seems hard work to get along. They are continually in hot water and make things unpleasant for themselves as well as others. The next man you go out with takes everything cool, and things always seem to run smooth him.

Find out for yourself the secret of the success of the one, and when you are promoted, see if you can't be a runner that all the "extras" will be glad to go out with. H. S. H.

Denver, Col.

"Drivers" on the Water.

Editor The Locomotive Engineer

How refreshing it is to read about the "drivers" and "stokers," and their abilities. It is hard to see what good it does to be extra well posted on the strength of material, etc., when, if you will not, or cannot pull those wagons, some other man will get the job, who is not so full of formulas. A little of the machine shop may be good in a "driver," especially if railroad companies would adopt the custom of sending a portable machine shop with every engine. What a lot of laborers there must be in the United States, and some of them are mean enough to walk off with $260 a month: pay sufficient for a good engineer. "Mechanic" mentions the engineers of ocean steamers as being criterions to cry by. My opinion is, that they are like any other class; some know their business and some don't.

I asked one of the engineers of the Cunard steamer "Cephalonia" how many times larger the low pressure cylinder was than the high pressure, and he could not tell. The engines of the "Pavonia" kept us all awake (going to the eastward) one trip with their pounding. Could it have been worse under the care of ordinary "drivers"?—not to any marked degree. Here's one nearer home: the engineer of the "Westfield," on his oath at the inquiry that was to determine the cause of the explosion on board, said that vacuum was *foul air!* Locomotive men ask some simple questions, sometimes, but shades of Watt and shadows of Stephenson! they can't and never will learn their business on the water or in a machine shop.

LITTLE BUTTE.

Albuquerque, N. M.

How Do Injectors Work?

Editor The Locomotive Engineer.

In your May issue there appears an article headed "How and Why Injectors Work," that I cannot let go unchallenged, although I may stand alone in the theories I advance.

If your theory—which is the general belief in the matter—is correct, how can an injector take steam from a boiler, make it take up water and deliver it into the *steam space* of the same boiler again? Is not the velocity caused by the pressure, and is it not as great at the check as at the injector throttle?

Now I have had some experience with injectors, and I claim that the size of the nozzles controls the range and action of the whole instrument.

If the steam nozzle is as large as the delivery nozzle, the instrument will throw lots of water—but not into the boiler. *Increase* the size of steam tube or *decrease* the size of delivery, and it will throw against the pressure of the boiler, and the larger you get the steam nozzle, and the smaller the delivery nozzle, the greater pressure it will throw against, taking steam from a boiler with 80 or 100 pounds pressure, and throwing water, in smaller quantity, into a boiler with 300 or 400 pounds pressure, the amount of pressure it will work against depending entirely on the difference in size of these two nozzles.

Do you claim that, by increasing the size of the steam tube, that you increase the velocity?

I look at an injector as a steam pump: the steam in an injector being the steam piston of the pump, and the delivery tube being the water cylinder; if the steam cylinder of a pump is twice as big as the water cylinder, it will force water four times as high, or against four times the pressure it would if both cylinders were the same size, making no allowance for friction. What is true of one is true of the other. The steam is a constantly moving series of pistons, always moving in one direction, and disappearing in their work, only to be reinforced by more pistons.

Without changing other conditions than the size of nozzles, you can make an injector do anything. Steam boiler testers are simply injectors with a very small delivery. Where does your velocity come in? LINE CHECK.

Germantown, Pa.

[The pressure at the check is at rest, confined, and is static force; the delivery of the injector is in motion, and is dynamic force; the blow of the water on the check is the action of a body in motion upon a body at rest. You can move a safe with a sledge hammer if the hammer has momentum enough.

By using a larger steam nozzle, you use more steam to force the same amount of water. An injector working with steam from one boiler, and forcing water into another boiler having greater pressure, is accomplished by using more steam to throw less water.

A hydraulic ram with but 10 foot fall will pump water up 100 feet; but by wasting water, until velocity enough has been gained to close a valve and strike the blow that puts water beyond the valve in the 100 foot pipe, so an injector wastes steam and water at the overflow until velocity enough has been gained to force the current of water and steam against the check.

If two horses of the same weight stand side and side, they do nothing; but let one stand still and represent static force—the pressure at the check—and let the other represent dynamic force, the force in motion—the current from the injector, and run against the horse at rest, the horse at rest will get moved, even though he were twice as heavy as the horse in motion.]

Help Yourself.

There has been considerable talk of late about mutual benefit associations and aid societies connected with shops and roads, and much good can be accomplished by such associations. Many engineers and firemen would organize, but do not know exactly how to go at it. We give below a copy of the constitution and by-laws of one of the most successful of these associations, conducted by the engineers of the D. & R. G. Ry. and A. T. & S. F. Ry., at Pueblo, Colo. On the first page should be a list of the officers and committees, and the name of road or divisions of different roads whose engineers are eligible to membership should follow the heading on the title-page.

CONSTITUTION AND BY-LAWS OF THE ENGINEERS MUTUAL BENEFIT ASSOCIATION.

ARTICLE I.

This association shall be known as the Engineers' Mutual Benefit Association of the —— Railroad.

ARTICLE II.

It shall have for its object the assistance of all members disabled by sickness or accident. The sum of twelve dollars per week to be paid, as the constitution and by-laws direct. Seven days to constitute a week.

ARTICLE III.

The officers of this association shall consist of a president, vice-president, an executive committee of ten members who shall be appointed by the president at the annual meeting in each year.

ARTICLE IV.

SECTION 1. It shall be the duty of the president to preside at all regular meetings. He shall have power, with consent of a majority of the executive committee, to call special meetings when and where he thinks best, for the best interest of the association.

SEC. 2. In the absence of the president the vice-president shall preside.

SEC. 3. The secretary shall give each member a dated and numbered receipt for each assessment as it is paid, and give credit on the books, or both; such receipt or credit shall be sufficient evidence of the good standing of the member, and entitle him to all benefits thereof.

ARTICLE V.

SECTION 1. The secretary shall act as treasurer and shall receive all moneys for this association, and hold the same subject to the order of the president and executive committee.

SEC. 2. He shall keep a true record of all the business and proceedings, and he shall also keep a record of all the members, and date of policies issued, and make a correct report of all receipts and expenditures, number of members and condition of association, semi annually, or oftener if required by a majority of the executive committee.

ARTICLE VI.

SECTION 1. All engineers running on the —— Railway shall be eligible to become a member of this association, and retain their membership for six months after leaving the employ of the company, if they remain within the jurisdiction, and then at the option of the executive committee.

ARTICLE VII.

When sickness or disability of any member of this association occurs, it shall be the duty of such sick or disabled member to notify the executive committee.

ARTICLE VIII.

SECTION 1. It shall be the duty of the executive committee to visit such sick and disabled members, and report the same to the president.

SEC. 2. Upon receipt of such reports the president shall order an assessment of twenty-five (25) cents or more per week upon each member of the association, to date from the day of such sickness or disability, or for the period of twenty-six (26) weeks unless otherwise ordered by a meeting of the association. Seven days constitute a week. In case the surplus fund be sufficient to pay assessments ordered, then the above assessment is not to be made.

SEC. 3. It shall be the duty of every member to bring the certificate from the physician when the executive committee demands it.

ARTICLE IX.

The secretary shall immediately proceed to collect the assessments when ordered by the president, and any member failing to pay any assessment within 30 days after ordered shall lose all rights in this association, and can only be admitted as new members. They will be governed by Articles 14 and 15 of Constitution and By-Laws.

ARTICLE X.

SECTION 1. There will be no benefit paid for less than two weeks, or the fractional part of a week, and such sickness or disability to date from the day of sickness, as per Section 2 of Article VII.

SEC 2. No benefit will be paid if sickness or disability is caused by immoral conduct, or the use of intoxicating liquors.

ARTICLE XI.

Expenses shall be defrayed by an equal assessment on all the members, but no assessment shall be ordered without the consent of the executive committee.

ARTICLE XII.

It shall be the duty of the executive committee to examine the books of the association and see that the accounts are correct and decide all questions of dispute that may arise previous to the meetings, and to fill all vacancies that may occur either in officers or committees.

ARTICLE XIII.

A fee of $1.50 will be required of every person on becoming a member of this association, the same to be paid over to the secretary, for the purpose of defraying the expenses of the association.

ARTICLE XIV.

Any member expelled may be reinstated by paying the admission fee, fifty cents, and a penalty of two dollars ($2) in addition, provided they receive a majority vote at a regular meeting of the association.

ARTICLE XV.

Any member forfeiting his membership the second time shall be governed by Article XIV, with this exception—shall pay a fine of $4, and if forfeited the third time shall never become a member again.

ARTICLE XVI.

Any member convicted for imposing upon this association in any manner, shall be expelled, and never again become a member.

ARTICLE XVII.

There shall be an assessment of one dollar for the purpose of a burial fund kept on hand, and an assessment shall be levied when it is used to replace it. The admission fee of one dollar shall apply on this fund.

ARTICLE XVIII.

Five or more persons shall constitute a quorum for the transaction of business.

ARTICLE XIX.

The secretary and treasurer shall be exempt from all assessments, as a compensation for his services as such officer.

ARTICLE XX.

This Constitution and By-Laws can be changed and amended by a two-third vote of all the members.

A notice blank is posted in roundhouses etc., when an assessment is to be levied, giving name of brother who has been sick, and number of weeks he was disabled; also if a brother has been killed—in which case a dollar extra is levied and kept on hand for a burial fund; this notice should be signed by the president and secretary. Annually the secretary and treasurer makes out and has printed a statement giving total amount of admission fees and assessments received to date, amounts of benefits and to whom paid, amount paid for printing, and balance on hand, amount outstanding and due from members, cost to each member for year, total number of members at beginning of year, new members received during year, number deceased, withdrawn or gone away, and total membership to date.

The second annual statement of the Pueblo association shows that they collected $1,031.00 during the year, paid benefits to the amount of $916.00, and $31.45 for printing; the total cost to members for thirteen months being $9.75, including one death assessment; total membership, 100. The assessments are rarely over $1.00, and as it cost but $9.75 during thirteeen months, it will be seen that for a very small sum an engineer can be assured of $50 per month if he is sick and disabled, and his family gets $100 for burial expenses in case of his death; as this amount is kept on hand and does not have to be collected the family have it at once, when it is so badly needed. The firemen at Pueblo have an association exactly like the engineers, except that their weekly benefits are $8 instead of $12, and assessments correspondingly cheap. Try it on your road. It is not a charity; you pay for it. Every brother on the road helps you to bear your misfortune and you help him in his.

Why Not?

There has been a number of runaways on roads where the automatic brake is in use, where part of the train was left on a grade while switching. The "tramp" lets off brakes. It would seem an easy matter to fix up some device that could be dropped on the track, or hooked to a rail, that would set the automatic if the train moved. A simple string or wire from the cock in the train pipe to a rail would pull the cock open and set the brake. But maybe the tramp would go along and "bleed" the brakes and let them slide just the same. There should be something on all cabooses to do this work. A man is the best thing, but the trouble is that he will have to do so many other things, the tramp gets the best of him. A string can't think, but it wouldn't have to flag or hunt links and pins.

New Idea on Flue Repairs.

The superintendent of machinery of one of the largest railroads of the Argentine Republic proposes to try a new plan of flue repairs. His road uses some of the worst water on earth, and, although boilers are washed out every trip, the flues soon become a solid mass of scale, making their removal costly and slow, and keeping many engines out of service for repairs. The plan proposed is to use separate flue sheets, front and back, into which all the tubes are expanded in the shop, and then the whole arrangement bolted into boiler by using tap bolts in flanges of heavy iron riveted in place of present flue sheets. The tubes and sheets would have to go in from the front of boiler, and the tap bolts on the fire-box end would have to go in from the inside of boiler; but by putting the flues in rows one above the other, and, perhaps, leaving out a few flues on the outside, the designer believes they can be got in; in removing he proposes to twist them out or twist the heads off. The man who proposes this novel idea is an intelligent mechanic, and does not think this a good thing for general use, but hopes that in his case it will serve to keep engines in service more months in the year. J. J. English, of the Baldwin Locomotive Works, who has recently returned from South America, says that the water in use on the southwestern deserts of the United States is no comparison to the stuff used on this road.

All communications relating to the business of this paper (except subscriptions) should be addressed:

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

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CONTENTS.

Revive the Practical Discussions.

Whatever else the organizations of engineers and firemen do—and they do much that is good, ennobling and charitable—they should pay more attention to the science of railroading, and discussions of the business of handling their engines, and doing the work of their employers. One of the main aims of any body of enginemen should be to make themselves better mechanics. They should study and discuss problems of the road, have models and books for general perusal that are too expensive for individuals to buy, and present such inducements that no good man could afford to lose the advantages offered by the brotherhoods.

It is well known that these discussions have fallen into disuse and decay, and the few lodge rooms that have valve gear models use them for hat racks more than means for information. The spirit of research should be encouraged to start, and made so interesting that none would wish to give it up.

It cannot be denied that there are in the country a large majority of engineers who would much rather condemn a thing than to honestly say that they did not know the principle of its operation. A little wholesome honesty with themselves would do all these men a world of good, and could do no harm to anyone.

Firemen, as a rule, are far more willing and anxious to study these subjects than are engineers, but why they should we do not see. There is a lot of honesty and force of character in an engineer who says frankly, "I don't know."

After a few years of running, the average engineer dreads to study or discuss questions where he knows he is on uncertain ground, and the more he avoids them the more insurmountable every molehill becomes.

No matter how much we don't want it, and don't believe it will ever come, the time is certainly coming when all firemen will have to pass an examination on adaptability, intelligence, sobriety, color blindness, etc., before they are allowed to fire; they will have to pass a rigid examination on time card rules, signals and the handling of engine and brakes, before they will be allowed to try their hands at the throttle. They will also have to be recommended by good engineers as first-class firemen. Men hunting jobs will have to pass rigid examinations; there will be no oldest man racket, no waiting for turn, but promotion on merit from top to bottom.

Let the enginemen of America be up and doing. It is their duty to so conduct themselves that they will court the examinations, and let them be so well posted that they can show and prove that nothing but an entirely practical examination is any protection to the public.

To be independent is to be well informed.

Study to be economical in supplies, and do the greatest amount of work with the least outlay of money. You would strive to do this if you were employed with a private firm, why is it a disgrace because you are employed by a railroad company?

Think of these things, men; they deserve your thoughtful consideration. Remember now these discussions in the days of thy youth, when the evil night run cometh not, and before you pull the plug on a scrap that has congestive chills, or the goose-neck is broken at the tender, or the wheel is busted on the right hand injector.

Scalping By Law.

A railroad company sold and delivered a 1,000-mile ticket to a purchaser who paid in money the usual rate to the class of travelers to which he belonged, and who secured it in ignorance of the following directions printed thereon: "Conductors will not honor this ticket unless properly stamped and signed by the purchaser, and will strictly enforce the above condition." Instructions of the company to its ticket agents, and the uniform custom regulating the sale of such tickets, required that the purchaser sign certain conditions printed thereon before delivery to them. The ticket in question was delivered to the purchaser and several times honored by the company's conductors without requiring him to sign the conditions. The Supreme Court of Ohio has just decided, in the case Kent *vs.* B. & O. Ry. Co., that. The company thereby waived such requirement, and its conductor was not justified in ejecting the purchaser from his car by reason of his refusal to sign the ticket and to pay the usual fare in money for his proposed passage.—*Ry. World.*

When the ifs and ands of ticket sales are done away with, and a ticket is good for the service it calls for, no matter who presents it, or how long after it is sold, so it has not been used, the better. "Good for this date and train only," "Good only when signed by the purchaser," etc., are a fraud and a curse. They leave many innocent purchasers with worthless tickets on their hands, for which they have paid full rates, then the managers weep because these tickets find their way into the hands of scalpers and say these men "fix their rates." Holy Moses!

Where is the Difference?

Senator Teller has introduced in the Senate a joint resolution declaring that all patents granted are for the actual use of the public, subject to the right of the inventor, discoverer or assignee, to receive the consideration for the use thereof, and must be put into actual use. Failure to put any patent into actual use within five years from the date of issue shall be held to be an abandonment of it, and thereafter the thing patented shall be public property and the patent ipso facto void.—*Ex.*

A great many papers are endorsing the above measure as a means of preventing inventors from demanding a tribute for merely thinking up a good thing, without actually manufacturing them, so that the public could have the benefit of their use. We do not see why an inventor has not as much right to hold his invention until the public necessities make it more valuable as a speculator has to hold vacant lots until the enterprise of others has made them more valuable.

The Wason Manufacturing Co. will build an $18,000 palace car for the king of Portugal.

The Master Mechanics' 21st Annual Meeting.

This meeting took place on June 19th, 20th and 21st, at Alexandria Bay, Thousand Islands, and was attended by a majority of the members. Mr. Setchel, the president, took occasion in his opening address to congratulate the association on reaching its majority, and to highly compliment Secretary Sinclair for his efficient work during the year. The secretary's report shows healthy condition of finances and an increase of membership.

The discussions were of an interesting character, but most of them show that the mechanics of the country are tired of the system long in vogue, of making inquiry by circulars issued by committees Reports based on the circular inquiry scheme were incomplete, and in many cases the committees complain that they received so few answers. Several committees were held over for another year for further consideration and study of their subjects. The master mechanics are very slow to adopt standards, but be it said to their credit that they have never been obliged to repudiate or change a standard once adopted.

It was shown that thousands of locomotives are now in service, whose running repairs are ⅓ less per mile run than the best practice 20 years ago; taking into consideration the increased complication, this item of itself would be good reason for the railroads to sustain this association at their own expense.

A great diversity of opinion and results in actual practice was noticed. This was especially true of the use of blind or bald tires on different wheels under 10-wheeled engines, in the use and advantage of extension fronts and the curving qualities of engines having rigid as against swing trucks.

The investigations of the committees, and the experience of such members as expressed themselves, seemed to be against the use of traction increasers and feed-water heaters.

By far the ablest and most important paper presented was the report of the committee to confer with committees of Master Car Builders and Wheel Makers' Association on the specifications, tests, and guarantee of cast-iron wheels. Chilled wheels are the cheapest wheels to be had, but the practice of contracting for wheels on the basis of price only has made it extremely difficult for makers of first-class wheels to compete in the open market, while the cheap wheels are constantly wrecking trains. In present practice the best wheel makers guarantee a certain mileage (from 50,000 to 70,000), and if the wheel gives out before that time—even by but a few hundred miles—the maker has to furnish a new wheel. Mr. Lauder, chairman of this committee, truly said this was robbery. On the other hand, if the wheel overruns its guarantee the maker gets nothing.

The new standard provides two tests, either of which may be used for each hundred wheels made; this test is to determine the strength and quality of material used, and of itself will exclude very inferior wheels, then the blank form of contract provides a certain price for each sized wheel, and a guarantee of service as follows:

36 inch passenger wheels,	70,000 miles.
33 " " "	60,000 "
36 " engine and tender wheels,	60,000 "
33 " " " " "	50,000 "
30 " " " " "	45,000 "
26 and 28 inch engine and tender wheels,	40,000 "
Refrigerator, through line and cattle cars,	24 months.
All other freight cars,	48 "

Should a wheel fail before this guarantee is reached, the maker is paid but a portion of the agreed price, based upon the miles the wheel has actually made; should the wheel run over the service guarantee, the maker gets a premium per mile over and above the first cost. The association put itself on record as endorsing this report for a future standard.

If it is adopted by the Master Mechanics and the Master Car Builders, the manufacturer of cast wheels will be stimulated to make the very best wheels they can, as the better they are the more money they get for them, while if a wheel falls just short of the gurantee, they get paid for the work it has done, instead of losing it entirely.

The report on guides was of interest, and favored the use of the Dean box-guide for 8 and 10-wheeled engines where it could be used, and the Penn. Standard open guides where the Dean could not be used, the Laird two-bar guide for consolidation, and the single beam guide for switching engines. Mr. Lauder, of the Old Colony Road, stated that he put a Dean guide on an 8-wheel engine five years ago last May, and the engine had been in service ever since, and he stated positively that the guide or crosshead had never been lined up since, nor did it now need it. This is, if true, the most remarkable record that ever came to our notice.

The association will meet in June next year, and the place of meeting will be decided within six months, by a committee who have the choice of Montreal, Niagara Falls or Chautauqua Lake.

The salary of the secretary was fixed at $1,200 per year, and all the old officers re-elected.

Many of the questions that came before this association will be discussed in future issues of this paper.

The Scribner Railroad Articles.

The long promised series of railroad articles have commenced in *Scribner's Magazine*, the June number containing the first article, by Thos. Curtis Clarke, entitled "The Building of the Railway."

From the high standing of the journal, and the corps of writers selected for the subject, the railroad men expected to find eminently interesting and absolutely correct information. The first article is excellent, yet we believe the author has allowed an inaccuracy or two to creep in.

On page 654 he says: "Now that the Westinghouse system of power-brakes on freight trains does away with the necessity of allowing head room for brakesmen on tops of the cars, two roads can cross each other with a vertical distance apart of but 13 or 14 feet, instead of 20 feet, and there is now no excuse for not adopting crossings at different levels."

If the advice given above were followed, our roads would become veritable man traps, even after the automatic coupler was adopted. There is never a freight train when it is not desirable or necessary that men should be on top of cars to give or receive signals, to use hand brakes when accident befalls the automatic, to go from engine to caboose, or to go to or from way cars, and a hundred other reasons.

Unless all freight cars have ways provided to go through them or along their sides, men must go over them—and it is the best place, especially for signaling. The day when low bridges can be used or should be tolerated has not come yet, and it will not in many years.

Again, in speaking of the practice of placing stone or gravel ballast on top of small bridges and culverts, Mr. Clarke says:

"By this means the usual shock felt in passing from the elastic embankment to the comparatively solid bridge will be done away."

It looks to a locomotive engineer as if this was the reverse of true. Is not the ground the comparatively solid, and the bridge the elastic part of the way? All enginemen know that an engine trembles and sways much more while on any ordinary wood, iron or steel bridge than they do on the other parts of the track. We have never built any bridge, or any railways, but we have rode an engine for years over a railroad having more bridges per mile than any other road in Christendom, and we cannot remember where a bridge ever felt "comparatively solid."

There has also been used a cut of Veta Pass, on the D & R. G. Ry., that is taken from a sketch with all the inaccuracies of a sketch, instead of from a photograph. Veta Pass is a low spot between two very high mountains, one of them, Sierra Blanca, being the highest in the range. This low pass is occupied by Dump Mountain, a small mountain that probably once sat as high as either of the two peaks, but slid down, hence its name. The cut leaves out the range, showing only Dump Mountain, and makes the road look out of all proportion, and as if they had built up to see if they could get on top. The cut also shows a double-header coming down the hill, 217 foot per mile, a rather unusual occurrence, although it is sometimes done.

ASKED & ANSWERED.

(37) T. L., Alexandria, Va., asks: What is good to prevent or stop foaming in the boiler when there is not time on the road to blow out or wash the tank? *A.*—We can offer little advice about feed water, not knowing the nature of the impurities. Lime might deposit some of it, but we should not use it under any circumstances, as it will deposit itself on the heating surface, making a very hard scale. If the water carries magnesia, soda might deposit some of it, but it would be necessary to blow out often. We do not

believe, on general principles, in putting one foreign, scale-making substance into a boiler to ren ove another. A good surface blow-off cock, properly located and intelligently used, would likely be of most service in your case.

(38) Rivet, Portland, Me., writes.

Have read of use of the Adamson joint in Strong locomotive boiler. What is it like? *A*.—The first boiler for Strong engine had joint like *a* between the fire-boxes and the combustion chamber; the rivets were in the water space, the object being to keep all rivets from the fire. The trouble was that when the joint leaked it could not be calked; the Adamson joint is like *b*, and similar to the other joint, except that it has a welt or strip between the lap of sheets, and allows the joint to be calked.

(39) F. H., N. Y. City, writes:

I have an engraving of a locomotive built many years ago by Hinkley & Drury. Can you inform me when that firm existed? *A*.—To the above question, F. D. Child, manager of the Hinkley Locomotive Co., Boston kindly replies: The first locomotive built by the firm of Hinkley & Drury, Boston, was delivered July 27th, 1841, to the Portland, Saco & Portsmouth R. R. She was called the "Cumberland." The concern was in existence and engaged in building boilers, etc., a number of years previous to above date.

(40) Pony, Leadville, Colo., asks:

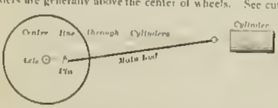
Why does the middle of a beam guide wear more than the ends? *A*.—Because the angularity of the rod is greatest when crosshead is in center of guide, and the greatest amount of work done then, and because the entire length of crosshead gibs rub the center of guide, while at the ends only a small part is touched.

(41) Reader, Gallion, O., asks.

What advantage had the old fashioned half stroke pumps? *A*.—They were behind the back driver, and not in the way of other machinery, and being operated by an independent crank on the back pin, would work when that side of engine was disconnected. Mishaps to valve motion piston or crossheads did not cripple the pump.

(42) Dead Center, Danville, Va., writes

What is the use of all the pinch bar business in getting crosshead on exact dead center? Can't a good mechanic tell by the side rod, as it stands over the axle, whether engine is on center or not by his eye. *A*.—"By the eye" is hardly close enough measurement for locomotive work. The reason that the dead center has to be found by pinching engine past center and back, measuring as they do, is that the center lines of cylinders are generally above the center of wheels. See cut



in which center line of cylinders is placed considerably above center of wheel to make it plain. As the main rod now stands, a line drawn from center of axle to center of main pin would be horizontal, but the engine would not be on her extreme dead center, the centre being about the point marked *X*.

(43) H. E. M., Monson, Me., asks:

Are locomotive driving wheels ever cast hollow, and if so, why? 2. Is a piece of pipe (iron) as strong or stronger than a bar of iron the same size? *A*—1. Driving wheels are generally cast hollow, to save metal, and because metal in the interior of heavy castings is not so strong as that near the outside, also to allow lead to be inserted to counterbalance, as it is heavier than iron. 2. No pipe is as strong as a solid bar of the same size; a pipe is much stronger for some uses than a solid bar of its own weight.

(44) J. D., Kamloops, B. C., writes:

On page 8 of your last paper you show cut of Rue Non-Lifter Injector. I want to ask the use or object of the button or valve held over the delivery tube by the spring, as shown. *A*.—It is the line check, there being none outside the injector casting.

IN THE ROUNDHOUSE AND REPAIR SHOP.

The new triple valve on improved air brake has no means of changing to straight air. It is automatic or nothing.

* * *

The Sterling Emery Wheel Co., 17 Dey street, New York, have favored us with their new catalogue of emery grinders and similar devices.

* * *

The secret of time is to keep moving. Delays, however short, if often repeated, kill the average mileage record easily. Be quick to oil, take water, clean fires, etc.—get away from stations.

* * *

The Master Mechanics decided that a step on the pilot of all engines was a needed appliance for the safety of the lives of trainmen. Good.

* * *

Angus Sinclair becomes editor in-chief of the *National Car and Locomotive Builder*, vice James Gillett, deceased. Mr. Sinclair will remove his office from Chicago to New York.

* * *

It is said that the inspectors of wheels on the passenger cars of the Delaware, Lackawanna & Western, at Hoboken, are paid a day's wages for each defective wheel discovered by them.

* * *

Many of the L engines have check valves that have a taper plug cock in the same casting with check, and between it and the boiler; this plug can be shut off and the check ground in with a full head of steam.

* * *

In nearly every instance where our correspondents report cuts in salaries of employes, the same communications also record the resignations of at least some of the best and most valuable employes on the line. In the face of this fact, who shall say that a reduction of salaries does not lower the grade of the service?—*Ry. Service Gazette.*

* * *

The American Train Dispatchers' Association are making laudable efforts to raise the pay of their members. Train dispatchers, as a rule, do not receive pay in proportion to the responsibilities they assume; they claim more pay on their merits, and have not declared that some other class of employes were receiving pay that belonged to them. We hope they will succeed.

* * *

The Deoxidized Metal Co., of Bridgeport, Conn., had an exhibition of their ware at the M. M's. convention, and remembered THE LOCOMOTIVE ENGINEER to the extent of enough desk jewelry to turn the head of a Pawnee squaw. Car brasses of this metal are now running on the Fitchburg road, that have been in use since Oct., '84, on the L. & N. since Jan., '85, and on the N. Y., N. H. & H. since Jan., '87, without change.

* * *

The surface blow-off has disappeared on a good many roads where they were once in use. There are two reasons for this; one is that the makers put about half of them from one to four inches below the upper gauge cock, and, of course, they were of no use; the other reason is that men don't believe in them and are too lazy to use them. Where they are properly located and used so that they blow water and steam alternately, they are a good thing, and rid the boiler of a great deal of impure matter.

* * *

Chas. Ellis, who has been connected with the Rue Injector Co., Philadelphia, for over 15 years, as secretary, has resigned that position, to go into the hardware business for himself. He carries with him the good will and best wishes of the company. H. F. Colvin has had the duties of secretary added to his office of general manager, with a proportionate raise of salary and a private secretary; his full title being now secretary and general manger. Their works are very busy.

* * *

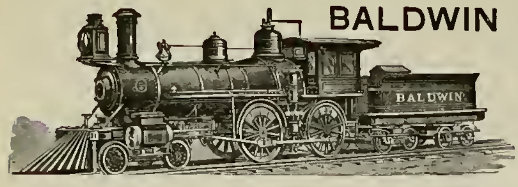
The writer recently had the pleasure of testing one of the new re-starting injectors made by William Sellers & Co. The instrument works admirably, and started itself repeatedly, after being broken, by admitting air to suction pipe, shutting off water, shutting off cock in feed pipe, and after heating injector and suction pipe as hot as steam would make it, by using heater. Since the instrument was shown in our April number, they have been put on over 60 different roads. Two or three years of road service only will disclose any weak points, if it has any.

* * *

We are in almost daily receipt of letters from all over the country, commenting on the excellence and usefulness of the air brake articles appearing in the paper; many subscriptions reading, "Commence with first paper on Air Brake Practice." The air brake has been adopted on many roads, and reliable instructions concerning it have never been furnished the men who use and keep it in repair. The articles are timely and able, and written in simple language, by an engineer having experience with the brake.

* * *

Soft plugs get about as little attention as any attachment to the locomotive; they are screwed into the crown sheet, and that is all, unless something happens to them. They should be taken out and scraped, at least once a month. On some roads a common iron plug is put in place of soft plug, and is, of course, no protection, but it is thick, and burns, and leaks, and will soon need new threads, or rather the sheet will need new threads and plug will need to be born again.



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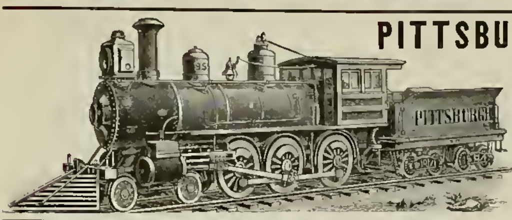

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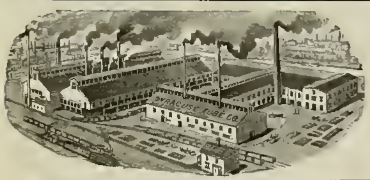

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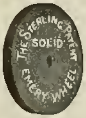

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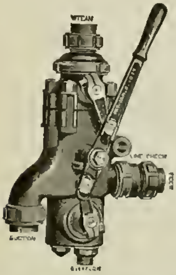

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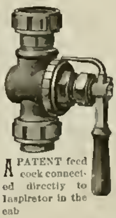

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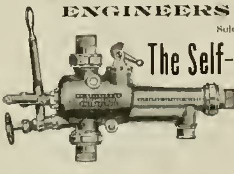

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The Locomotive Engineer.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

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Historical Locomotives.

FIRST SKETCH.

We present on this page the picture of a locomotive that has had her name indelibly written in the history of our country.

The cut represents the locomotive "General," on the Western & Atlantic Railroad, substantially as she appears now and did on April 12, 1862, when she was captured at Big Shanty, Ga., by 22 daring Union soldiers and brought North; the object being to burn the bridges, cut the telegraph lines, etc., thus cutting off the supplies of the Confederate army at Chattanooga, Tenn.

The party of Federal soldiers were in command of J. J. Andrews, a Kentuckian; their daring feat of going many miles into the enemy's country, stealing the "General" and three cars while the crew were at breakfast, in plain sight of 3,000 Confederate soldiers, and their race North, their attempts to burn bridges, etc., that were frustrated by the close pursuit by Conductor Fuller and some of his men, their final break for the woods and their capture by mounted militia, their trial by court martial and the execution of eight of their number as spies is well known. In case they succeeded they were to receive $60,000. The survivors were granted a gold medal by Congress.

The "General" is a Roger engine—as old railroaders would know by the top of her sand-box;—she is in active service yet, pulling a light train, as she is rather small cylinder and light weight, but has 5 foot 10 inch wheels; she is a wood-burner, and has very recently made some fast time, but certainly made as good time as there was in her on that memorable day in 1862.

The "General" was also under fire at the battle of Kennesaw Mountain, June 27, 1864; having taken a train load of ammunition to the front, she was detained there during the fight, and took the wounded men from Featherstone's division to Marietta and Atlanta.

She was also the last locomotive to leave Atlanta when Hood evacuated, and her last service to the Confederacy was to take a big load of refugees and war material to the South.

The Danforth & Cook locomotive "Texas," that finally overhauled the "General," when her fuel was exhausted and her brave crew had burned the roof of a car, her tank-boxes and oil-cans, is still doing service on the same road. We are indebted to Jas. M. Brown, G. F. & P. A. of the Western & Atlanta road, for copy of illustration and other data used in this sketch.

Extension Fronts.

In many of the plans of extension fronts the netting is placed above the line of the flues. It is evident, from a very slight examination of the matter, that you want as much area of netting as is possible, and the netting, therefore, should extend from the deflector plate ahead in the center of the boiler, giving the full width of boiler to netting. What is considered an excellent arrangement for discharging cinders in one place will not do at all in another; the roadmaster that has stone ballast won't listen to the idea of blowing out on the road and between the rails. Another company object to the side shute because it dirties up the sides of cuts and makes the road look bad. Some companies don't care what you do, so you don't pile them onto the cars, and get in on time. Probably the best all-around arrangement is to use netting coarse enough to let out all but the big cinders and dump these in pits at stated places on the road where stops are made for water or other causes calling for a stop of several minutes. The extension front has come to stay along with the brick arch and the smooth-bore stack.

Burning Caking Coal.

On some of the roads in the Mississippi Valley a very poor quality of coal is burned; it melts and runs through the grates, and if allowed to stand so, will become one solid mass of melted grates and slag. To burn it with success it is necessary to carry a thin fire, keep the coal dancing on grates, when engine is temporarily shut off use blower enough to keep fire burning brightly, use a slice bar occasionally, never permit the fire to get thick or die out in the corners. Intelligent care alone makes it possible to use such fuel, and that it is used so successfully is a credit to the enginemen who handle it.

Breaking in Locomotives.

The intelligence, care and experience displayed by the man who "breaks in" locomotives just out of the repair shop, determines to a considerable extent the good running and length of service of the locomotive.

If the "tamer" is a careless, reckless or ignorant man, and gets any part of the engine hot and cutting, it will very likely give more or less trouble as long as the engine runs.

It is the usual practice to put an engine together just as she is expected to run, set her valves and turn her over to the "tamer," and we never saw one go out that way that did not have to go back more than once for finishing touches; rods bind, driving boxes heat, and valves get a little "out" when the engine is under steam that were all right when she was cold in the shop.

Frank C. Smith, Master Mechanic of the Peoria, Decatur & Evansville road, seems to pursue a reasonable and sensible course in "breaking in" his engines. He sends the engine out of the shop with only the main rods up, and runs her that way until there is nothing that gives trouble, all driving boxes are running cool, etc., then he has the solid rods put on, so that they are just right when the engine is hot and ready for work; the valves are set while the engine is moving under steam.

It is safe to say that engines got ready for work in this way will give less trouble than those adjusted in the shop by any rule. For instance, solid-ended side rods should be put up at the right length for the work, and the right length can only be proven when the engine is doing or in condition to do that work.

Setting Slide Valves.

We are in receipt of many letters like the two given below:

"Will you give rule for setting valves after engine comes out of shop? Suppose eccentrics are keyed on, but blades have slipped on eccentric straps, or some similar mishap, how are the marks made on the valve stem, and how do they use them to re-set valves?"

"Will you give the general method of setting valves on a locomotive, and the position the reverse lever should be in on the different centers?"

One writer says he has been studying the subject up, but got all tangled up in formulas about eccentrics, rocker arms and link suspension, before he got to the rule for running over valves, and, when he got there, there were so many references to

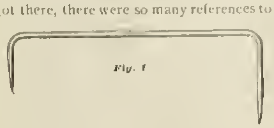


Fig. 1

those points that he never learned just what to do and why he did it, to run over valves in the roundhouse.

We will suppose that the eccentrics are properly set on the shaft and keyed there, that the suspension studs and the rocker arms are properly located, etc.; in fact, we will suppose that the engine has just been rebuilt, her eccentrics are known to be all right, but the blades have been put up any way, and it falls to the lot of our reader to "run her valves over."

In the first place, before the steam chest covers are put on, get your "port marks." To do this, secure a piece of tin or Russia iron about the length of the port, and a tram. Most roads use a standard tram. The best for this purpose is one made like Fig. 1, made of ½ inch steel, with finely ground and hardened points, of such length that, when the long point is inserted in a prick-punch hole on the top of cylinder, outside of chest, and the short point touching the valve rod, the long part of tram will be parallel with the top of rod, it should be of such length as to carry its point entirely beyond the coupling of the valve stem to the rod in any part of its travel. With a sharp scriber, scratch a line on the valve rod in the direction of its length *A B* in Fig. 2. If you are to set valves regular, it will pay you to buy or make a key seat rule for this purpose, the end section appearing like Fig 3; this will always bring this line straight with rod.

Now move your reverse lever (no matter where the engine stands) until one of the ports is uncovered, then insert your tin and hold it in the port, and let your helper move the lever slowly, until the valve pinches the tin just enough so that it is a little hard to move; hold lever in this position, place the tram in the center mark on cylinder casting, and bring the other point down on the line on the valve rod, and scratch *across* the line, then with a fine prick-punch make a mark where the lines cross, enlarging and changing its position

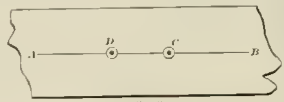


Fig. 2

until when about $\frac{1}{16}$ deep the tram comes fairly into its center; change your reverse lever and get the port mark for the other port in the same way, then you will have the two marks *C* and *D* (Fig. 2); do the same on the other side. These marks show the lap of the valve; if these two marks are an inch and a half apart, the valve is that much wider than the ports, and is said to have ¾th lap—¾th over each port when the valve is in the center. Now, by using a tram of the same length, it will not be necessary to get these marks again while the engine has the same valves.

Some shops set the valves while the main

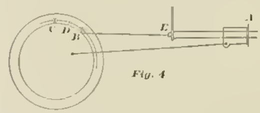


Fig. 4

drivers are on rollers, but we believe that the proper way is to make the final adjustments while the engine is moving herself under steam; by this means all the expansion and all the lost motion is taken up just as it is in every-day practice.

See that the main wedges are set up snugly and both ends of the main rod properly keyed. You will now have to get the dead centers, to prove the proper location of the eccentrics and ensure an equal lead at all points. To do this, another tram must be made that will reach from the guide yoke, frame, or wheel cover, to the upper part of main driving wheel. (See Fig. 4.) We will suppose in this case it reaches from guide yoke. Pinch the engine ahead—for

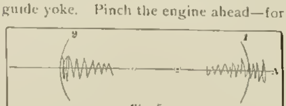


Fig. 5

forward centers, and back for back centers—until the crosshead approaches the end of stroke, say an inch or inch and a half, chalk the guide and make a mark on it as at *A*, using edge of crosshead or a point on it, and a pair of dividers to get this mark; put one end of your tram in point on yoke marked *E*, the other point against tire of wheel, and on a line drawn an inch or so from *inside* of tire by a pair of dividers, and make the punch mark *B*, take out your tram, pinch your engine ahead until the crosshead has passed the center and *passed* the mark on guide, then pinch back carefully until crosshead is exactly to mark *A*, then tram to wheel again, making mark *C*, bisect the distance between *B* and *C*, making the mark *D*, pinch the engine back until the tram comes into this mark, and the engine will be on the extreme dead center, regardless of lost motion. Now, with the lever in any notch, the distance the tram point is from the mark *C*, Fig. 2, is the amount of lead the valve has for that port and that point of cut-off. You will have to get all four dead centers in the same way.

Now all the setting there is to do, is to get the valve to travel in the center of its seat. With a little lampblack and oil on your finger, smear the valve rod just enough to show a scratch easily.

With the tram in the mark on cylinder casting, have the engine moved ahead slowly, under steam, with the lever at full stroke, and, as the stem approaches the ends of travel, scratch it across with the point of tram; it is well to do this through several revolutions, to be sure of your marks. This will give you a stem marked something like Fig. 5. Supposing *X* to be the end of stem toward chest, it would be plain, by putting on a divider and drawing the lines 1 and 2, that the stem was traveling too far ahead, by say ¼ of an inch, and, if the rocker arms are of the same length, mark on the running board, L. G. H., ⅛, which means in English, "lengthen the go ahead eccentric blade ⅛ of an


Fig. 3


Fig. 6

inch," which will make the valve travel in the center. For the back-up motion, run the engine backward, lever in back notch, proceed in the same way. It is needless to say that the other side must be done the same. When the valves travel in the center, when being actuated by each eccentric, the "setting" is done. It is well to run over the forward motion with the lever in the notch generally used, to see that the lead is the same on both sides, and the travel all right, which it will be if the engine is well designed.

To increase the lead, move the eccentric ahead on shaft; this will increase the lead, hasten the point of cut-off, exhaust and compression. Where eccentrics are keyed on they can be set forward or back, by using an off-set key, like Fig. 6.

We hope to make the sketches on "Historical Locomotives" of interest to all our readers. Anyone knowing of the whereabouts of engines, or reliable data concerning them, that have taken a prominent part in any events of moment to our country or the development of the science of railroading, we shall be under obligations if they will acquaint us with the facts.

It is claimed that the engine pulling Jay Gould's special car between Chattanooga and Knoxville, on the East Tennessee, Virginia and Georgia Railroad, a few weeks ago, made the 112 miles between these two cities in 107 minutes. For a long run, this, if true, is indeed remarkable time.

Usefulness on the Retired List.

At the Jersey City shops of the Erie road there is an old-time locomotive of the six-foot gauge, the only one the company has left. The engine is an old-fashioned and light weight machine with a single pair of drivers; her tank has been discarded and a couple of light tanks placed under her cab, and a small coal bunker inside it; she is rigidly coupled to the transfer table and has about 200 feet of track that she may call her own; she moves the entire table, thus doing away with the usual crank and gear system; being quicker than such schemes, she saves lots of time. These shops are so arranged that the table must be moved oftener than transfer tables usually are; barrows, trucks, etc., are transferred from one shop and one yard to several others. Where much material is handled, would it not be a paying investment to couple an old, light weight engine to the table and put a man in charge of her and use the tables more than they are now?

A Fast Run for a Narrow Gauge.

On June 21st, an excursion train left Ouray, Col., for Salt Lake City, over the Denver & Rio Grande road, 3-foot gauge, and went to Salt Lake, 416 miles, in 16 hours and 30 minutes, including two stops for meals and several to change engines, etc. The road is partly mountain and very crooked, and some of it is desert. Between Dallas and Montrose, 48 miles were made in an hour, and on the level, desert division, west of Montrose, the speed reached 55 miles per hour. We are in receipt of Salt Lake and Ouray papers, giving accounts of the run, and also letters from several railroad men there confirming the reports. It is the best narrow gauge record we know of, and, if true, is fast enough for anybody.

In Case of Wreck.

Don't make out a report that you were running ten miles per hour, when it is plain to anybody that you were going thirty or more. We once knew an engineer that went into the ditch with a stock train. The road held the men down to fifteen miles per hour, but on this occasion had given orders allowing eighteen miles per hour. After the wreck the crew did not meet, as the conductor walked back to a station to telegraph. The telegram was answered by the wrecking car, with several officials on board. The conductor told his story to them, but at the wreck the engineer was not seen, having gone home slightly hurt.

In a few days he was called to the superintendent's office, and asked how fast he was running when the wreck occurred. "Just about as fast as the forty-seven could turn a wheel," was the answer.

"No mistake about this?" asked the superintendent.

"Why, you don't think I was running faster do you?"

"No, but someone is a liar. Here is the conductor's report, that says speed did not exceed seventeen miles per hour. Now we wanted that stock got over the road just as bad as you men wanted to get over. All this inquiry is for, is to learn how the accident happened. When your engine is ready, you take her out. That conductor either lied or else he is no judge of speed; in either case, we don't want him. If you had sung the same song I should have discharged you."

What is true of one thing is true of another; tell the truth and shame the division superintendent.

A Feast To-Day—Famine To-Morrow.

"Orders have been issued by the Philadelphia & Reading management, directing engineers and firemen all over the system to report to the superintendents of their respective divisions, instead of to the superintendent of motive power at Reading. This change in the organization of the transportation department will tend, it is claimed, to a greater economy in operating expenses, by concentrating authority in the hands of the division superintendent. No material reduction in the force of locomotive men will be made, but the superintendent is expected to get more work out of the locomotives by this arrangement than was possible under the old plan.—*Ry. Age.*

The division superintendents will probably make a big showing of more work for a few months, then the rolling stock will be about paralyzed, and a master mechanic will be appointed to get it in shape. The interference of the transportation department with the motive power is one of the most prolific causes of dilapidation, disaster and receivership.

Outlandish Names.

The tendency of trainmen to invent odd names for rolling stock and their attachments is often amusing. All railroad men are familiar with the odd appellations bestowed upon locomotives, from the days of the "grasshoppers," "crabs" and "camel backs" to the modern genus of "hogs." The Wisconsin Central officers have been annoyed of late by a disrespectful name given by their trainmen to an artistic effort to put a distinguishing mark upon the rolling stock belonging to the company. The mark consists of a neat red shield placed on each locomotive and car, with the number painted in the middle. The trainmen have dubbed the shield the "liver pad."—*National Car and Locomotive Builder.*

Really the men name everything introduced on the road. George Richardson, although a locomotive engineer himself, had no idea of calling his safety-valve a "pop" until the road men forced that name onto the device. The Mason-Farlie locomotives with Walschaert valve gear on the Denver & South Park and the Denver & New Orleans were at once dubbed "jim-crows," and they never got rid of the name. The old locomotives with sloping fire boxes were known as "fan tails," and now Cushing's modification of the Wooten dust burner is a "mother hubbard." On half the roads in the country an injector is called a "refrigerator," a "cooler" or a "squirt." The vacuum brake is known as the "wind jamb," the caboose as the "dog house," the "monkey box" or the "ark," while the speed recorder has always been the "Dutch clock," but the worst we have heard of yet is the long equalizer from driving spring system to pony truck, on consolidation engines, that the Missouri Pacific boys have named the "Aleck."

Air Brake Practice.

BY J. E. PHELAN.

FOURTH PAPER.

The most important principle to study and practice in handling automatic air brakes is economy of air supply; that is, to do the best possible work with the least amount in pressure or volume of compressed air.

The point for study now is how to accomplish effective work with economy of air supply. To accomplish such effective work requires accurate judgment, constant watchfulness, and careful handling of air brake appliances.

The aim should be to make a stop with but one application of the brakes; that is, after once applying the brakes they should not be released and then re-set in order to stop at desired point. By this it must not be inferred that trains should approach stations or stopping places at a reckless rate of speed, and have brakes suddenly applied to make a sudden stop. This would not show good judgment.

It can be noticed in all Westinghouse illustrations or sectional views of triple valves, the position of the main slide valve that works in connection with the piston of triple valve. Within this slide valve is a small valve that acts automatically and independent in action, in response to slight reduction of air pressure in train pipe. This small valve acts as a medium for light application of brakes, opening a small passage for air to flow from auxiliary to brake cylinder without forcing triple valve to act in opening full passage through slide valve, as for full application of brakes. For illustration, let the engineer apply brakes lightly by moving engineer's valve so as to reduce 3 to 5 pounds' pressure from train pipe. In response to this reduction, triple valve acts, but does not move down far enough to open main passage from auxiliary reservoir to brake cylinder. But it moves down far enough to bring this small valve within slide valve into action, allowing a limited amount of air to flow into brake cylinder. To accomplish this the triple valve has moved down until it rests on the graduating spring in drain cup of triple valve. After making reduction for this purpose, engineer's valve is blanked so air stops escaping, and communication is shut off from main reservoir to train pipe and auxiliaries. Under such conditions the graduating spring forces triple valve up to limit of spring. This does not go far enough up to allow brakes to release, but stops flow of air into brake cylinder, and, as a matter of course, the air that has reached brake cylinder acts expansively in keeping up light application of brakes.

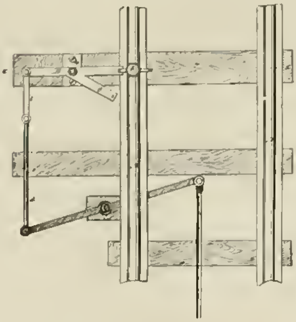
The point to be guarded against is not to trust this condition too long; for action of rods, etc., may draw pistons past limit of leakage grooves and brakes release in this way. It should be the aim of engineers to use this medium for setting brakes as much as possible. It is economical on air supply, places less strain on brake levers, brake shoes and wheels, and is always desirable in making smooth stops, so that passengers may not know that brakes are applied except as indicated by gradual slacking of speed.

The rule to govern this practice for slight application and gradual stop lies in handling engineer's valve to obtain results; first applying the brakes by slight reductions from train pipe and keeping up application by repeated light reductions, as circumstances may require. In making stops, engineers should always take into consideration the grade of roadbed, condition of brakes, and all circumstances bearing on the service in hand. A train can be stopped with very little air on ascending grade, while a stopping place on a descending grade requires cautious work, more time, and increased care.

In early air brake practice, it was taught that a reduction of 10 or 12 pounds' air pressure from train pipe would be necessary to insure application of brakes It was given as a reason that such a reduction was necessary to insure piston in brake cylinder traveling past leakage groove, which usually terminates three inches from end of cylinder. It is to be hoped that this idea is exploded. It is also hoped that the practice of applying brakes so hard that engineers can feel them forcibly taking hold in a sudden manner, while passengers brace themselves for the final stop, may be short lived. It should be settled beyond doubt that those who apply brakes suddenly and as suddenly check speed, release brakes for a short distance and then suddenly reset them for a jerking stop, don't understand their business, and are not good air brake men

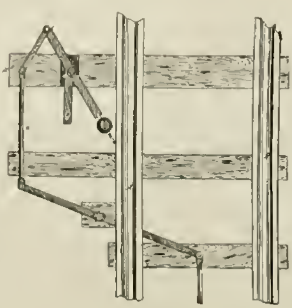
Ordinarily, with brakes in good order, a reduction of 3, 5 or 8 lbs.' air pressure, according to number of cars in train, rate of speed running, and kind of grade approaching stopping place, will give good results. Follow the rule of light application, with repeated light reductions by engineer's valve at safe distance, so that speed will gradually slacken—almost inperceptibly at first, and the approach may be made and final stop accomplished with but one application of brakes. Releasing and resetting brakes uses up reserve pressure in main reservoir, so that final application and release is roughly made at best. It is a mistaken practice to crowd brakes to stop at water tanks or other points, in attempting to be flip. A gradual approach should be made to all stopping places. Another matter, approaching stopping place at high rate of speed; engineers check speed sometimes too soon, and imagining they will stop short, release brakes, and when coming to make the stop, find it necessary to crowd brakes and waste a great deal of air to do so. In such matters it will be found that if engineer's valve is left blanked, instead of releasing brakes, train will keep moving until point of stopping is reached. When it is positively necessary to release in order to avoid stopping short, it is good practice to allow train to come fully under control down to six or eight miles per hour, then the final application to stop will be a light one.

Engineers should never take chances on running by any stopping point. In air brake practice, the engineer's judgement should always take counsel from prudence and cautious self-reliance.



Williams' Torpedo Placer.

The device here shown is designed as an attachment to any switch, signal or drawbridge mechanism, as an extra safety precaution. If used in connection with a distance signal in bad weather there is not the chance for accident there is without it. In use the strap of the torpedo is placed in a slot that fits it in the arm, and is held away from rail, except when signal is turned against the train, when it is brought directly over rail; there is an extra arm to use in case it is attached to a



3-throw switch, being arranged to place a torpedo either way it is turned. The cuts show the placer attached directly to the lock bolt of a drawbridge, and it is intended, when used for this purpose, that when a train passes over it, and comes to a standstill, the train crew will replace the torpedo exploded. There is no machine work on the device, being all plain castings, the estimated cost for arm, bed block and bolt being but 55 cents. Further information can be obtained by addressing the inventor, M. D. Williams, High Bridge, N. Y. Mr. Williams is a conductor on the Northern R'y.

The Largest Yet.

The new engines of the Reading road, designed by Mr. Cushing, have cylinders 22x28 inches, boiler shells 72 inches diameter. These consolidations take the glory all out of the Northern Pacific "Decapods," 22x26, with boiler 68 inches. Recent tests have shown that the big boiler is an improvement, and already the Central of N. J. and the N. P. have ordered engines of this size, showing how soon others will follow an advance step, if that advance is proven to be well taken. Mr. Cushing calls his new engines "Octapods."

The Modernized Wootten.

J. Snowden Bell, of Pittsburgh, Pa., takes the editor of this paper to task for remarks made about the Wootten fire-box engines in the last issue, and writes to the *R'y Gazette* to that effect, and, among other remarks asks:

"Are the new express engines to be discarded because of their great weight, because 'they look like locomotives,' or because they are 'modern;' and in the latter case, in what particular does their objectionable *modernness* consist? Is a 'Wootten fire-box mill' (first built in 1877) more or less *modern* than the new express engines of the ordinary type, with Milholland fire-boxes (first built in 1860), and have the new express engines proven themselves capable of equaling the performance of the 'Wootten fire-box mill'?

"I submit the above inquiries in the hope of obtaining some definite information as to the new engines referred to, in which, from a cursory inspection, I have been unable to discern any feature of novelty, or any peculiarity beyond their excessive weight."

The writer is unduly "soon" in his remarks, as perhaps we were in ours The item that stirred up Mr. Bell was written when a report was published in the *R'y Gazette*, stating that a test had been made with engines with the Wootten boiler and of the wagon top, and giving the Wootten a big record over the later, stating that no more of them would be built. But the engineer of tests of this road has now come forward and corrected these statements. Now we will say what we believe to be the truth.

The Wootten fire-box does just what its inventor intended it should—burns very fine coal (buckwheat size)—it does not and cannot burn culm or dirt. We claimed that the fire-box was too big, because no man could keep the grates covered as they should be; this is proven by Mr. Cushing's experiments. He uses the Wootten box, remember, not the Milholland, but has made it very much narrower, and the tests just completed show that it does better than the extra big box. We believe that the new shape of box will be easier to stay and keep in shape than the old boxes—their weakest point. The Wootten fire-box engines on express do not burn buckwheat coal, because with this fuel it is necessary to clean fires very often—they use lump coal.

The new Cushing engines are heavy, but they have *modernized* Wootten fire-boxes, their superiority and economy have been established, and we venture the assertion that the Wootten Locomotive Co. will, in the future, sell more of this style than of the old style.

Correspondence

Expansible Crosshead Pins.

Editor The Locomotive Engineer:

We have been testing the open or English crosshead, so extensively used on some of our leading roads, and considered by many mechanics to be first-class for locomotive and stationary use, owing to less winding wear on guides, and the use of solid end main rods; but the principal objection has been in the difficulty in putting in a suitable keying arrangement. Some roads use a transverse key in main rod, but in this method the movement of the key is very limited. Other roads use no key at all, and work with this disadvantage because of the many good qualities in this crosshead. The expansible pin, we have found, however, to have completely overcome these obstacles. We have given these pins a test of 27 months on one engine alone, and are satisfied that the design of this crosshead is complete with the expansible pins. The accompanying drawing represents a pin just as it was applied to one of our engines 27 months ago, and since then we have equipped 5 more engines. The first engine is a 16x24, 8-wheel, American type, local passenger engine, making about 3,200 miles per month. This engine went out of the shop in March, 1886, and from that time to date the front ends of the main rods have not been down or removed from the crosshead. The actual mileage to date for this engine is 74,977. You will note on examination of the drawing that the general make-up of this pin is that of the style used in the Laird or Mogul crosshead, excepting here is a short split bushing outside of all, *abutting against, but not entering, the walls* of crosshead. This is the expansion bushing, and is held from turning in rod brass, by having square ends, which engage in slots, allowing bushing to open or close forward and back, the direction of expansion and wear of brasses.

Should you wish to take up the lost motion, slack off nuts *A*, Fig. 1, which frees the center bolt *B*, allowing hollow bolt *C* to be moved. Set up nuts *D*; this draws hollow bolt *C* through, which expands bushing *E* forward and aft; nuts *A* are set up again, which hold hollow bolt *C* firmly in walls of crosshead, as shown in Fig. 4, the key on end of bolt *B* preventing the pin from turning, and its taper expands pin firmly in crosshead. We find that the engineer sets up nuts *D* a little each week, amounting to $\frac{1}{8}$th of a turn of

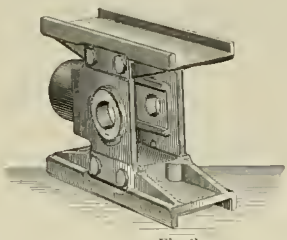
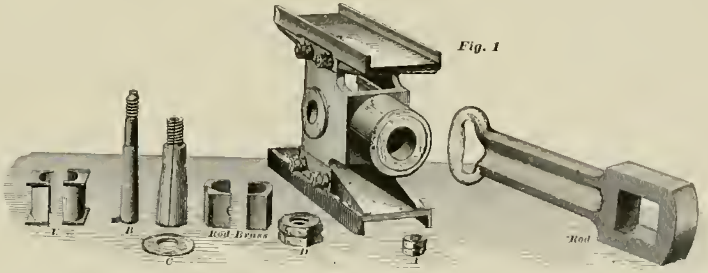


Fig. 2

them per month, or $\frac{1}{100}$th of an inch expansion or wear of brasses. Now, as there are $\frac{31}{100}$ths of an inch limited expansion of bushing, and as for the past 27 months there has been about $\frac{27}{100}$ths of an inch wear of brass, it is safe to estimate that the engine in question will run nearly 31 months before the limit of expansion is reached, and before it is necessary to take down the rods to close the brasses; so, as the engines of this class and service go in for repairs every 24 to 30 months, the rods may remain untouched until engine is shopped. This pin can be applied to any style of crosshead where a loose pin is used. The second engine supplied with these pins is a 17x24, 8 wheel, American type, through passenger service, making the first six months 6,100 miles a month and afterward 3,200 miles a month. At the end of four months the foreman of shops examined the pins and considered them to be in better condition for the service rendered than any he had ever seen; from that time to date the rods have not been down. The total mileage is 64,248. We have this pin on four other engines in different service, with equally good results for mileage made. These engines have been run by different men who have kept up the wear, and have had no trouble from pounding and heating; so we have seen that it requires no practice for engineers to learn how much to expand bushing. Practice has shown that the pin is firmer and stronger than the ordinary one, and will not get loose in the walls of crosshead, and, furthermore, brasses can be worn much thinner than by the common keying arrangement. It is quite noticeable that the side rods on all these engines run longer without keying, because of the fine adjustment at the front end, the whole train of connections is kept up in better shape. I am pleased to say that I am entirely satisfied with the workings of these pins, for we have a good crosshead complete with pin; we have less and longer wear of brasses, a solid end main rod of simple construction, length of main rod more nearly preserved and less labor in lining and closing brasses. This Expansible Connecting Pin was invented by H M. Montgomery, of Boston, Massachusetts who has secured it by letters patent both, in the United States and Canada. It is the intention of this company to apply these pins as fast as is practicable to our locomotives.

Fig. 1



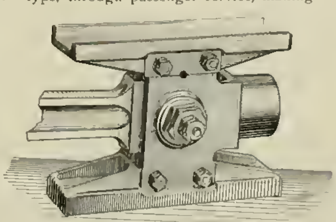


Fig. 3

J. B HENNEY,
Supt. M. P., N. Y. & N. E. R'y.
Norwood, Mass.

[The crosshead pin described above was brought before the Master Mechanics' Convention by their committee on crossheads and guides, and called out so much favorable comment that we consider it of interest to all enginemen on the road and in the shop. The tests made by Mr. Henney seem to be very complete and conclusive. The first cost is probably three times the cost of a common pin, but not more than the cost of loose rod-strap, bolts and key ends.]

Brass Eagles.

Editor The Locomotive Engineer:

Talking about brass eagles reminds me that some twenty years ago I had a fireman who had a mania for ornamental brass work. He had extra flag staffs, waste cups and torches; he had a whirligig on the headlight and a flumadiddle on the sand box, and one day he found a couple of fancy brass ornaments representing a brass squirrel in the act of eating a brass acorn—came off an old pair of andirons, I believe. Well, he polished them up and fastened them to a ball on the front end of hand rails, and they looked real nice—to him. I had not seen them and did not know they were there. We went out on the night express, and as long as I kept my head out of the window they did not show. when we were well out on the road I shut the side window and lit my pipe, and as I raised my eyes to the track, after putting away my tobacco, that squirrel loomed up in direct line with the rails, and looked for all the world just like a human form ten or fifteen yards from the pilot. I shut my eyes to keep out the horrid sight, jammed the throttle shut and squaked for brakes—that was before the days of air. We stopped, backed up and hunted for the mangled remains. The train men guyed me a good deal, but I felt sure the victim had had a miraculous escape. We went on, but before we had got a mile I saw that same tramp on the track, and began to think the engine or myself were being haunted. I went out to turn up the headlight, and found my tramp, and I brained him with a monkey-wrench. And to the day he died that fireman believed that we struck something that time, for it carried away his squirrel.

Elmira, N. Y. ELMIRA.

Slipping in Starting a Train.

Editor The Locomotive Engineer:

We have a grade here where all trains are obliged to stop, and unless they get a heavy train far enough over the grade it is almost impossible to start it. A train was recently stuck here, and one engineer in a crowd who were watching it said the train could be started if the engineer would slip the engine; all hands laughed at him, and told him to go and start the train by slipping, and he did.

Now the man who was running the engine had her on sand, and would take the slack, but could not start the train or get the slack of half of it. Some of the engineers said it was because the engine was "blind," and when one side was at the quarter the other side was on the center, and the valve did not uncover the port and give her any steam; it has since been proven that the engine had 1/8 of an inch lead and was all right. If you will let a little light in on the subject, it will help out a fireman who wants to know.

Denver, Colo. XXX.

[In the first instance the engine had but the pressure on one piston to do the work, which was not enough; the piston that stopped on the center had no power, even with the port wide open, because the crank-pin was on the center. By getting the engine off the sand and letting her slip the momentum of her own moving parts helped her over the centers, and allowed her to develop the power of both cylinders, which exerted a steady pull on the train and slowly brought it into motion; this done, the momentum of train will carry engines over the dead centers, and any amount of sand can be used, as no slip is necessary or of use.]

How to Stall on the Hill.

Editor The Locomotive Engineer:

I had about come to the conclusion that I might make a good fireman, or possibly a fair to middling engineer, but had better stop letting my ink bottle slop over so often, just because I was interested in a subject; but I see that several railroad papers have copied all or part of my article in your July number (and part of them without credit) that I thought perhaps you and the reading enginemen and railroad mechanics of the country would tolerate another dose or two from me. The kid has been giving me some pointers again, and I want to show them off.

We have got a "hole" on our division, and the new engineer usually hangs up there—so do lots of the old ones. The kid don't hang up, and he gets over or out so easy I remarked that he was the only man I had fired for who did, and asked him to explain, as I couldn't see but that other men got their trains to going faster before they struck "the hole" and worked the engines harder to get out.

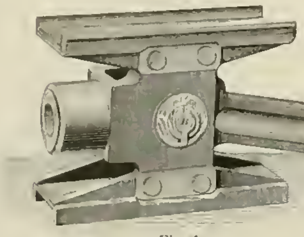


Fig. 1

SEE PAGE 5.

"That's the trouble," said the kid, "they work them too hard. Now they take a long run for the 'hole,' and just as soon as they pitch into it they pull the throttle wide open, drop the lever down among the oil cans and—stall. What stops 'em? Why, steam stops 'em, and nothing else. You take an engine and start out of a station and try to run fast without hooking the lever up, and you can't work your train up to any kind of speed at all. Why? Just because the steam follows the piston nearly its full stroke, it is admitted at chest pressure almost until it is released to the exhaust, and it takes time for it to get out of itself, and if you want it out in a hurry it takes power to get it out, until the power required to draw your train and to overcome that back pressure has used up all the power in the locomotive, and you are done; she will go so fast, but no faster; she has got her steam brake on. If you want to increase your speed your must use all the steam you can, and get rid of it. Now when those fellows strike the hole at 30 miles per hour with a big train and drop the lever into the corner they are simply choking their engine down and using up the reserve power stored in the momentum of the train.

"I just keep her hooked up and let her hit the other side of the 'hole,' going as fast as she will, and commence to drop her lever a notch at a time only as she commences to slow down. The slower she goes the further down I work her and the harder she will pull."

It may seem wrong to men who think it is a mere matter of how hard you work an engine; but, come to think of it, is not the kid's idea the correct one? Wouldn't a little judgment and thought placed over on the right-hand among the levers be as productive of good results as if mixed with the coal on Michael O'Toole's leadless shovel?

Galveston, Texas. TEXAS.

A Conundrum.

Editor The Locomotive Engineer:

Here is a question for my fellow readers of THE LOCOMOTIVE ENGINEER. A few years since I was firing an engine that was setting cars for a steam shovel. The engine was in use night and day. One night she refused to move, regardless of the night crew's efforts to make her. Three or four engineers who examined her case pronounced her dry pipe bursted, and they had all left her where she was standing. When we arrived on the scene my plug puller asked what was the matter, and was told. He ordered the night man to get up and open the cylinder cocks and move her if she would move. It was tried, but she did not go. Then he called them all to him and says: "You fellows don't know anything; that engine is all right and will go right off." Then he got up opened the throttle, and she did go. There was a foolish-looking set of men around there, and they don't know yet where the trouble was. Who can tell where it was?

McArthur, Ohio. WM. R. CLINE.

Two Wipers.

Editor The Locomotive Engineer:

I have been watching the difference in the way two young men on one of the prominent roads in New York State wipe engines.

They both work together, and Jim Poor always takes the right side of engine, while Jack Good is satisfied with the left. Of course there is nothing in that, but the right side is nearest the throttle, and that is why Jim Poor wants it. The said Poor will stroll up to an engine with a half important, lazy look, and make an effort to push a piece of waste along the end and top of steam chest, then drop down to guide, wipe it with waste filled with cinders and dust, when all of a sudden he discovers a little dirt along the front wheel guard, gives it a rub, his hand will then drop—of its own weight—down on side rods, and so along to the cab. Then comes the inspection, here a rub and there a rub, and then he decides "good enough," sit down to wait for Jack, who comes up as though he meant business, wipes all uppermost parts first, and carefully getting in each nook and corner down to the rail, wipes all of one piece before starting on another, goes over each part second time with clean waste, and when *he* reaches the cab, leaves it for some one else to inspect, if they wish.

It is needless to say what a contrast exists on engines wiped by these young men.

On opening up conversation with Jim Poor, he will strive to show how important a man he is about the roundhouse and tell you all the gossip about the engineers and firemen, but when asked if he expected to go firing soon, it was:

"Naw, a fellow don't get a show here unless you have a pull with the 'M. M.;' been wiping about two years, and it's time I had a better job, but they won't give it to me."

A few days later we managed to get in conversation with Jack, and found he had only been employed as wiper for a year and has made several trips as extra fireman; he feels quite hopeful of a chance of firing.

No preaching is necessary. The above facts ought to suggest what is expected of a young man who wants to get above drudgery. Systematic industry and faithfulness makes a good lubrication, and will have to be used abundantly before you can take hold ofthe throttle.

Troy, N. Y. TROJAN.

A Red Reminder.

Editor The Locomotive Engineer.

I am one of those runners who are foolish enough to spend $27.00 for a fine locomotive clock, and if I could not get another, no man could buy mine for four times $27.00.

Not only does it keep the best of time, but it stands there in front of me all the time with its case open, fairly begging to be looked at; if I am making a close run I always look at my watch, too, and as this gives me two times to compare, there is little room for mistakes.

On our road we use the "do not" order yet, and I am always afraid of it, and anything that will remind me of it is welcome. I always read the order to the fireman, and hang it on a hook where I can see it, and yet I have several times come within half a finger length (Mrs. A.'s measurement) of going by the "do not" station. One day, after one of these close calls, I conceived the idea of gluing a small block of wood onto the glass of my clock face, and screwing to it a long, red, dumb hand, and then dividing off the circle of the dial case and putting on it the numbers of each telegraph station, so that when I got a "do not" I could just move the red hand around to the proper station number, but I never got as far as the numbers on the case. I use the time figures—clock has a 24 hour dial—and when I get a "do not," I set the red hand at or about the time I should arrive at my "do not" station.

When I start out on a run I look to my first meeting point for a superior class train, and set the red hand to that time, and I find it a great help. It takes but a second to set it, it does not interfere with the clock, and is a simple safeguard against cases of doubt; and the way I look at these things, locomotive engineers can't have too many safeguards.

Do you think some of the makers of fine locomotive clocks would lose anything if they would fix up some neat little scheme of this kind and let the boys know of it? I should also suggest that locomotive clocks have the glass circle screw on against a felt ring and that they be arranged to wind, set and regulate from the outside of the case while the engine is running, if necessary, and by the use of keys, the holes or plugs being so arranged that no one without the key could meddle with the adjustment, and that would not be in the way of cleaning the case.

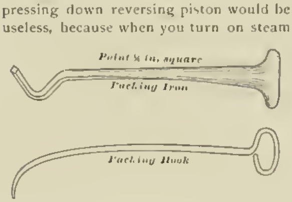
A fifty cent license has saved the pelt of a $400.00 dog; a $2.00 lightning rod has saved a big house from paralyzation, and a 30 cent telltale with a red pointer might save a train load of umbrella frames or straw hats.

JOHN ALEXANDER.

Packing Tools for Air Pumps—That Pump that Would Not Go.

Editor The Locomotive Engineer

F. E. R., Laramie City, Wyo. Ter., in reply to my question in June number, is way off, because if, as he says, the lower nut on main steam valve was loose the cylinder would take steam at both ends, on account of pistons on end of main steam valve separating; therefore, taking off cap and pressing down reversing piston would be useless, because when you turn on steam



the pistons on main steam valve separate as before. Guess again, Mr. F. E. R., L. C. W. T.

C. S. B., of Bennington, Vt., is wrong also. Although, as he says, if the button on end of valve stem was off, the pump would act as I have described it, but that was not the cause of my trouble. I hope C. S. B. will try again.

Bent Wire to hold up Nut and Gland.

As the question has not been answered correctly, I will tell you what I found; it was this: A rubber gasket from steam pipe had been drawn into the main steam valve chamber, and up into the steam port that runs from main steam valve chamber to the reversing valve bush, thereby stopping up the cylinder end of the port. As I always use copper gaskets for steam pipe joints I did not think of looking for rubber in such a place as that, and as I only examined that part of the port that runs through the cylinder head I had to work about four hours, where I could have done the whole in fifteen minutes if I had known what the trouble was.

John Reynolds, Kansas City, Mo., says a Westinghouse air pump is a mean thing to pack; and so they are, unless you have tools the right shape; here is a sketch of the tools I use. Try them, John; they save burning your fingers

I have just overhauled an air pump and put it in as good shape as it can be put in. The steam cylinder has been bored out, new bushes put in, new rings all around, new reversing valve and stem, and new reversing piston, and still it don't work. This is the way it acts: The piston will go up about half way and then reverse its motion, once in a while making a full stroke. Who will tell me what ails the pump?

Syracuse, N. Y. W. F. R.

Convention Thoughts.

Editor The Locomotive Engineer

"'Rah" for the glorious Fourth of July, but remember the poor railroader don't get much of a holiday. As a general thing, when everybody else is out for a day of pleasure, the railroad men conduce greatly to the world's enjoyment by putting in double time, and yet how few of the thousands who ride so safely from one end of this land to the other ever think of the two men on the engine, and while many speak a kind word of and to the gentlemanly conductor, how few ever go forward to give a word of praise or a cigar to the men of the oil can or shovel.

The conventions have met, transacted some very important business, given us some good data from which to work, but yet we find that many men have many minds; and yet it may be that the different locations and circumstances have much to do with the difference of opinion. With regard to boilers, fire-boxes, smoke-boxes, nozzles, etc., there will always be room for improvement. If we are to carry 160 pounds' pressure of steam (and I don't think that will be the limit), there must be a larger heating surface, according to weight, than we had when carrying 120 pounds. To get this increase means more boiler; in fact, I never saw one too large, and very few fire-boxes large enough; and if the walls of the fire-box evaporate six to ten times as much water per square foot as the tubes, it would seem to be good policy to give us all the fire-box and grate surface possible.

By the way, I am glad to see some tests have been made on the Philadelphia and Reading. One recorded in several papers shows the value of the large fire-box for burning inferior fuel. Of course the P. & R. have the advantage of cheap fuel, there being thousands of tons of the screenings of anthracite coal that can only be used by the Wooton fire-box and a fine grate. It may be that the Wooton box may be wider than necessary, as they claim to have gained some advantages with them made 18" narrower by Mr. G. W. Cushing's order, which would leave them 75" to 80" wide by 108" long. Four feet of the grate at the back end is covered with fire brick 4" or 6" thick, which, becoming red or white hot, makes a good gas or smoke burner for bituminous coal.

But the strangest thing of all was the idea of making openings in the smoke-box to improve the steaming qualities. Some of us old fellows have been working with might and main to keep out every particle of air except what came through the flues. If air gets into an extension box it don't take long to have a fire-box on both ends of the boiler, and lots of fun getting out burnt bolts and making steam pipe joints.

I see a sketch in *R. R. Gazette*, June 29th, of Mr. Lander's plan of putting in pipes to support brick arch which is very good, but if the water should be in any way bad, a brass plug in the outside sheet, opposite the end of the pipe, would be valuable, as the plug could be taken out and a rod run through the arch pipe, cleaning it out every time the boiler was washed.

Among the many exhibits at the M. M Convention were some drawings of an improvement to the link, by H. G. Manning, late of the B. & A. R. R. While there have been many trying to do away with the link, and none have succeeded very well, I think Mr. Manning has got on the right track in improving the present link motion. According to the cards taken from this motion, it would seem to be a valuable improvement. I hope some railroad company will give him a chance to prove its value.

I have been amused sometimes watching an engineer trying to oil the lower side of a top guide, pour it on the lower guide and then oil the top bar with his fingers. If he had only turned the crooked end of the spout up and raised the can, the oil would flow up against it and what fell down would oil the lower one

Watertown, N. Y. J. J. BINGLEY.

Another View of Hospitals.

Editor The Locomotive Engineer.

Considerable has been said pro and con about the railroad hospital, and I should like to present one argument in favor of the hospital. I am sure they are a good thing, even under poor management, as men are apt to be improvident, and in case of sickness or accident many of them would become objects of charity, were it not for a system compelling them to provide for themselves. And we no doubt would pay more to assist destitute cases appealing to our sympathies than we now do as hospital dues, and that, too, without a chance of sharing in the benefits of such a system.

A railroad company should not be expected to pay for all sickness, for a great deal of it is not contracted from the effects of any service required. Therefore we must provide for ourselves in the form of insurance. Hospital dues should be looked at in the same light as insurance. It is worth what it costs to carry it, and if we don't get sick or hurt, we are only out our premium.

A man may at any time draw out more than the value of a year's dues; when he does not, some one else does. When he leaves the employ of the company his insurance expires. Having been worth what it cost, he should not expect to acquire stock in the company, to draw a pension, or to have a life lease on a berth in a home for the friendless, although of course, if maimed in the discharge of his duty, he naturally expects some consideration; but railroad companies are not remarkable for even justice, to say nothing of charity

Those of us who can afford better attention than fifty cents per month calls for, can easily pay our dues, for the benefit of those less favored.

Of course those who think they know enough to take care of themselves, do not fancy the idea of having money taken from them, and used without their consent. They would rather pay a dollar of their own free will than a nickel by force.

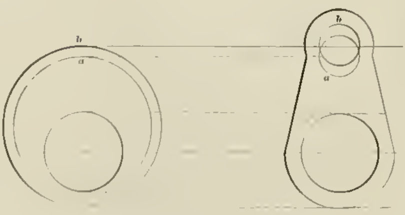
There may be objections to the company hospital as commonly run, but in a new country, where accommodations are scarce, they are all right, especially to single men. There are bad features in the system, but the good ones more than equal the bad.

Pueblo, Colo. WM. H. HUBBARD.

Turning Off Eccentrics.

Editor The Locomotive Engineer:

I have been into a discussion for six months about turning off an eccentric without changing the throw. I send a cut that my engineer says is all right, and that if you turn off a quarter of an inch you decrease the throw; he says it is the same as if you set the crank pin nearer



the center of wheel. If it was not so why do they have to make new straps when eccentric is turned? I claim it makes no difference—who is right? Give an easy way to tell the throw of an eccentric.

Galesburg, Ill. FIREMAN.

[You are right. The turning off of eccentric makes no difference; the distance from center of axle to center of eccentric determines its throw; in turning off outside you have not disturbed this. The crank example is wrong—turning off outside of eccentric would be equivalent to reducing the size of crank pin, which would not decrease its throw. The *difference* between the short side and the long side of an eccentric is equal to its throw. The diameter may be ten inches or ten feet.]

Air Pump Repairs.

Editor The Locomotive Engineer:

The cigar forwarded by W. F. R., in answer to his Air Pump Conundrum, in your April issue, was duly received by me. I did not get your June edition until a few days ago, and then had not time to read it through, but noticed the conundrum again put in by W. F. R. In answer to it I think the trouble was in the steam port, for communication of steam between the two pistons of the main valve, and to the valve chamber in the top head (which regulates the pressure on the reversing piston) getting stopped by some means (probably by the joint on cylinder head), thus making the reversing piston of no use and consequently stopping the pump from working. F. J.

Sault Ste. Marie, Ont., Canada.

A Box that Never Gets Hot.

Editor The Locomotive Engineer:

A specimen copy of your paper is before me, with which I am very much pleased. Yesterday, while running along, a friend pointed towards the left-hand trail wheel of the back truck. I told my fireman (*pro tem.*), an ebony-hued son of Ham, to see if that box was smoking; he looked into the tool box and replied in the negative. I, like Mr. John Alexander, looked at him in a fatherly sort of way, but as it was 20 miles to a stop, I couldn't get even by using the finger beam. My fireman said I needn't worry about that box—it never got hot. Send me the L. E. regular. E. C. S.

Chumuckla, Florida.

Why Won't They Slip?

Editor The Locomotive Engineer:

On our road here we have a number of sags and hills, as I suppose most roads have, and the way all our engines act on these hills has been a matter that has got me all tangled up.

It is a fact well known to all locomotive enginemen that locomotives have much larger cylinders than they need, to *pull* their trains, but they do need the big cylinders to *start* trains One beauty of the link motion is that it virtually reduces the size of the cylinder when hooked up.

Now we all know that it is little or no trouble to slip an engine under ordinary circumstances; they are enough over-cylindered to slip; if you are working your train into speed, and do so slowly, you need not slip, but if you try to hurry you will slip.

Now what worries me is this: Take one of our sags, we have 50 loads, which is, say, twice as much as the engine will pull out of the sag if she stalls; we "take a run for it" and get up to, say, 25 miles per hour; now when we are working up this speed we can slip the engines any time by hurrying them a little; if we stop in the sag and try to start they will slip, but if we run at the hill, and after striking it at a good speed, and the train commences to lose speed you cannot make those engines "fly up" if you try—I have tried. This is what sticks me. Now the same engines will slip on the same hill with four cars if you crowd them. This is not once, it is all the time, and I know engineers and firemen who could tell the same experience if they took particular notice of similar cases. Now there is some reason for this; can you tell me what in the name of common sense it is?

Trinidad, Col. SLIPPER.

[As long as you are trying to store up work in the train it is possible to make an engine slip; the momentum of the train is a reservoir into which you can store energy or work. If you supply more work than can be converted into speed in a given time it will run to waste in slipping, just as you can pour a gallon of water into a small-mouthed jug, if you take time enough; hurry, supply more water than will go in on the instant, and it runs over. Now in running for the hill you are converting work into motion and storing up power to help you over the hill; as soon as you strike the grade and commence to lose speed you are drawing on your reserve. The locomotive is pulling, but not 50 cars, the momentum is pushing. Suppose on your grade you suddenly cut off your engine, the train will follow until all its stored-up power is given out in overcoming friction, the resistance of the atmosphere, and carrying itself forward. Now when on this grade say you have slowed down to 15 miles per hour, your engine won't slip perceptibly, because the first inclination she has to slip reduces her own speed, and the momentum of the train instantly reduces the load on her draw bar, thus relieving her to that extent from the work of pulling the train, thereby enabling her to use more power in moving herself instead of the train.]

Standard Sizes for Locomotive Repairs.

Editor The Locomotive Engineer.

The modern plan of building locomotives and other machinery on the interchangeable system renders it a comparatively easy matter to maintain standard lengths and sizes in making repairs in the roundhouse and machine shop.

In the olden time, when no two engines were alike, even from the same builder, and when contracts were given to several different firms for locomotives, there was some excuse for an irregular system, or no system, in making repairs, but those days are gone, and roads now, or, at least, new roads, are equipped with engines from one builder.

It is a bad practice to alter the length of a spring hanger in order to equalize an engine. The spring is at fault, and not the hanger. The spring is changeable, its "set" is sometimes more, sometimes less. The hanger is rigid, and does not change. Make up for the weakness of the spring by putting liners, or "Dutchmen," under the gib in hanger, and when you get a spring that has full set, take liners out. When hangers are repaired, bring them back to the original length. Find out from a new engine what that length should be, and make a drawing or templet of the same, and keep it as a standard for the men to work by. If this plan were adopted, it would save a vast amount of "cutting and trying." As an example, suppose that an engine has one weak spring. The foreman or machinist gives it a squint, and reasons, very properly, that if those two hangers were shortened just a little, or that spring saddle lengthened a trifle, she would sit all right; suiting the action to the word, the work is done. After a few trips that particular spring breaks, and a new one must take its place. What is the result? Another man puts it in, he sees that something is wrong; just what, he does not know; but one thing is quite evident, that spring gear is all out of whack, and so he tinkers at this or that hanger, puts a different shape to equalizer, saddle or something, he don't care much what—anything, so as to make her set level.

The standard set of each spring should be known, and the spring compared with that standard before being put in, and, if weak, pick out the liners to make it up to "correct pitch" before you put it in. It will save lots of jacking and sweat this hot weather.

After a few years, if a haphazard style of repairing is carried on, there will be no standards, and it will be impossible, without a great amount of study, to tell what the original size was.

The same may be said of the other parts of a locomotive, set screws, nuts, keys, etc. Keep them to standard. By so doing, a supply can be kept on hand, and not a great variety either, always ready for an emergency, and sure to fit. 'Twill save many extra jobs at night and on Sunday. The expense of keeping up engines will be greatly reduced and their life prolonged.

It will save much wear and tear on the foreman. Every repair shop on the road should be furnished from the general shop with a complete set of blue prints of all parts of the engines, or at least of those pieces that will have to be repaired. From these prints patterns or templets can be made for the use of blacksmith or machinist. Jigs can be made for drilling holes, so that the labor of laying out can in a large measure be done away with.

See that the men are thoroughly informed on these points. The foreman's labor should be to think them out, and instruct the men in their use, and see that they are taken care of, and kept to standard.

Pueblo, Col. Hiram R. Jones.

Stone, Pinkerton and Dynamite.

Early in this month the country was startled with the announcement that the C., B. & Q. officials had unearthed a plot to use dynamite to destroy their property, and arrested several ex-employes of the road. It now seems as if part of the dynamiters own up to being Pinkerton detectives, and others have become conscience-stricken and "informed."

A large portion of the press of the country have turned themselves loose, and are howling about the debauched Brotherhoods, etc. We do not believe for an instant that the road can prove its charges; it looks like a Pinkerton plot all the way through. If anyone has been guilty of inciting riot and teaching the use of explosives, it has been the detectives who were into the scheme. We believe the rank and file of the B. L. E., far and near, would like to see all who can be convicted of any part in the plots punished for their crimes, be they engineers, informers or detectives.

The Engineers' and Firemen's Brotherhoods at large will be as blameless, should all charges be proven, as are the present members of Christian churches for the burning of witches at Salem 200 years ago.

Not as Bad as if it was Twice as Bad.

Hereafter the watches of the Pennsylvania railroad trainmen must be examined by a jeweler. If a watch is in good running order the owner is given a certificate, which he must present before he is permitted to take a train out. The owner of any watch that does not pass muster is compelled to purchase another or leave the company's employ. All watches must be inspected once a month, for which the company pays. There is a great deal of dissatisfaction among the men over the new rule.—*Daily Paper.*

The company are liberal compared with some of the roads that want the men to pay for their own examinations and patronize the company watchmaker too. The companies should own and issue the watches.

Same Here.

The best mining experts usually wear overalls and a blue shirt, and are pretty well spattered with candle grease. It may take them a month, or six months, to examine a mine, but the report will be short. "She's a dandy," or "she ain't worth a cuss," will be the report, and it will be practically correct. The professional expert, with his name parted in the middle and a mystical handle attachment, may, after a few hours' examination, write a long winded report with high-sounding phrases, but it will not be as reliable as the judgment of the intelligent miner who has worked for months in the mine.—*Red Cliff* (Col.) *Times.*

The above remarks are true of all trades. The technical school graduate knows all about the proper proportions of machinery, but in nine cases out of ten he can't take a lathe or drill press and make anything but repair bills. The devices used on locomotives can be best tested by locomotive engineers and firemen, and the goggle-eyed expert don't successfully run locomotives to any great extent.

The car couplers were out in force at the M. C. B. and M. M's Associations; after the decision of the former adopting the vertical plane hook, many of the link and pin men went home disgusted.

The Brotherhood of Locomotive Engineers will celebrate their 25th birthday at the city of their nativity, Detroit, on August 17. A big crowd is expected to take part. Their regular convention will be held at Richmond, Va., in October.

Some roads are building locomotives with no brace between boiler and frame at all, except the cylinder saddles and the connections at fire box. On the other hand, D. Clark, M. M. at Hazelton, Pa., on the L. V. R'y, is putting two extra heavy braces between the saddles and the tumbling shaft, and believes they are an improvement over the single brace. Who is right?

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

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CONTENTS.

Ridiculous Claims.

At the Master Mechanics' meeting, the Westinghouse people displayed sections of their new, quick-acting triple valve, and the new engineer's brake-valve, and we heard the man in charge say to a mechanic who was examining the devices: "You see, from here to here is the movement for all ordinary stops, but when you throw the handle around here it opens these large ports and allows the air to escape, by this large passage, around the piston-valve, and is the position for emergency stops; the idea is this: *It makes the blockhead just as good a man with the air as the best engineer you have got!*" This remark opened the throttle of our thinker, and she was making 74 miles per hour from Alexandria Bay until she collided with a Jersey City ferry; we got her stopped here and were feeling around for hot boxes, when a couple of young bloods stopped side of us and one commenced to tell the other what a great time he had the night before. He had taken a party of girls out for an airing in his new-fangled naphtha launch, and launch, naphtha and girls had all got on fire and the girls jumped overboard. It so happened that they were on a mud bank, and in only two or three feet of water, or the girls would doubtless have been drowned.

"What did the engineer do?" asked his friend.

"Oh, you don't need no engineer; I was running her myself, you know; something was wrong or out of kilter, that's all!"

Then we got a paper and read an advertisement of a "No"—engine, no engineer, no expense, no explosion, no insurance, no repairs.

They ought to add: No sense, no work, no safety, no good.

There are too many devices being manufactured that people have to risk their lives on, that require no skill, intelligence or attention (?). In the case of the air-brake, there is little fear that its new valve will induce master mechanics to let it try to make their poorest engineers as reliable as the carefulest and best. The new valve is better than the old one, but it requires as much or more skill to handle it with safety and certainty; it requires judgment to use it. Any machine or device of that kind that will not do better work, more work, and do it safer and surer in the hands of a skilled engineer or mechanic than it will in the hands of the best blockhead on earth, is a bad device; claims to the contrary are ridiculous claims. You cannot make skill of brass or brains of babbitt metal.

Some Figures of the Strike.

A great many newspapers are just now very busy presenting to the laboring men of the country, "some figures of the strike," wherein they show how the Brotherhood of Locomotive Engineers and Firemen, by assessing themselves $5 per month, are expending the sum of $132,000 per month to support the strikers. There are always two sides to a story, and we herewith present "some figures of the strike" from the other side—their own figures.

The Chicago, Burlington & Quincy Railroad's statement for May shows: Decrease in gross earnings, $402,885; increase in operating expenses, $400,545, and decrease in net earnings, $803,430. January 1st to May 31st: Decrease in gross earnings, $3,113,240; increase in operating expenses, $1,081,362, and decrease in net earnings, $4,194,602.

Thus it would seem that, in addition to having an immense property on its hands doing but 30 per cent. of its original business, and losing in the above ratio all the time, it has cost the company something to sustain the struggle and pay advertising rates for articles on "figures of the strike," and in announcements that the strike was over. The strike commenced the latter part of February, and the statement dates back to January 1st, to make the loss appear less per month. As a matter of fact, the strike has cost the road just about $1,500,000 per month—their own figures. How long would this sum have paid the engineers the little extra to bring their wages up to standard pay?

The strike may have been won by the company, but we venture to say that there are few other companies that care to win one in the same way. Verily, "some figures of the strike" are not all on one side of the ledger.

To Hog or Not to Hog, that is the Question.

Engines on many roads are now "chain-ganged" or run the rounds. "Hogging it" the Pennsylvania boys call it. There are no regular engines; a man runs one engine to-day and don't expect to see her again for a week or a month. On some passenger runs two men run one engine or three men run two engines, but on freight it is first in first out, engines and men alike, and as there are more men than engines the latter are kept hot and busy. By this system less money is invested in power, engines are worn out sooner and new ones are modern; men running or firing engines do no work on them; a man is kept at shops to wipe off engines, clean flues, etc., another packs, cleans headlights and draws supplies. On some of the roads a blank form is furnished the engineers, to report their work, and a number of questions have to be checked yes or no. Men report valve stem glands screwed up, or a wick put in gauge lamp, rather than do it themselves.

This system of running has its advantages, and perhaps some disadvantages. As a rule, the engineers like their own engines, but we believe the "hogging" principle a good one if the work is done on the engines. It relieves men of lots of roundhouse work, especially the firemen, and it keeps men with notions from doing damage in the front end. It may make an engineer a machine who cares nothing for his engine, and may in time produce a set of men more helpless in case of a breakdown than the present but we do not believe it will.

After all, the engineer is the brains of a locomotive; he does the thinking and she does the work, and he is expected to direct his energies to the work of transporting passengers and merchandise, and not to repairs. Should the practice come into general use, many of the boys would have to hunt up some other excuse for staying down town four hours every trip "to pack." We would like to hear from some of the men on the chain gang, as to its advantages and disadvantages, from their point of view.

Radial Stays in Wagon Top Boilers.

Heretofore the use of radial stays has been confined to straight boilers, owing to the impossibility of staying crown sheet, under the dome. N. W. Sample, Supt. of M. P. & M. of the D. & R. G. Railway, rebuilt a number of 10-wheelers that had small, straight boilers; a very large wagon top was put onto them, extending far enough ahead of the crown sheet to carry the dome. The engines did remarkably well with the improvement, and, we understand it has been patented, the patent being now owned by the Baldwin Locomotive Works, Philadelphia. These works have been the most enthusiastic believers in the safety, durability, and cheapness of repairs, as well as first cost of this method of staying, and time and experience are showing the correctness of these views.

There is little doubt that, in a few years, crown bars will be the exception, rather than the rule, in American locomotive practice

Another Toothpick Bridge.

On the 12th of last month a heavily laden passenger train broke through a trestle 48 feet high, on the Virginia Midland road, near Orange station. Six persons were killed outright, and 25 or more injured. The trestle was old, rotten and weak, and was being filled in; the train was running but 6 miles per hour, under slow orders. The engine was nearly across the trestle when it broke down in the center, yet the reports state that one of the cars *ran off the track and tore the bridge down.*

Such talk is all bosh; all the bridges that break down are not caused by cars jumping the track. They are running trains and engines of double the weight they were ten years ago, and the old, rotten bridges have been kept in service to help out on the dividends A few wholesome verdicts by coroners' juries would be a great protection to the lives of enginemen as well as the public.

A Long Run and Fast Time.

Engineering, London, states that the highest speed any train is timed at, from start to stop, is the Great Northern Manchester up express, which is 54 miles per hour. This probably beats any card time in the United States, but the statement that this is also the longest regular run in the world without a stop, being 108 miles 26 chains, seems broad. Cannot some of our roads show a train that makes this distance without stopping? We don't expect to hear of its being done in their time, however—1 hour, 57 minutes.

Avoidable Butcheries.

On the night of July 17th there was a collision on the L. & N., near Birmingham, Alabama, in which an engineer and a fireman were instantly killed and another fireman received fatal injuries, another engineer is severely wounded. It is said the cause of the accident was that the watch of the surviving engineer was 25 minutes slow. This will be ground enough for many roads to declare that watches of engineers and conductors shall be examined periodically, and compared with the standard clock daily. This ruling will not prevent accidents of this kind; men are too hard run to always compare with the clock, and engineers will compare watches with the conductor. All kinds of watches will be used. Let the companies own the watches or clocks, keep them in repair, and issue them to the engineer and conductors with their running orders, including in the order the numbers of the watches received. By this system no watch will be out long enough to run down; it will be set to the second every trip; standard time will be maintained and correct watches carried. The cost of an accident like the one cited would buy watches for a dozen roads.

At the M M 's convention last month there was a short discussion on the proper place for blind or bald tires on 10-wheeled engines, and whether or no it was desirable to use swing trucks One man stated that he had a large number of this class of engines, and found that where the engines had rigid trucks they did not curve so well or save their tires. He said he had one engine with rigid truck that had cut her flanges until she had ¾ of an inch of lateral motion, and this in but eight months, while a similar engine with swing trucks had run two years and worn her ties but ⅜ of an inch.

M. N. Forney's article, American Locomotives and Cars, in the August *Century*, is by far the best and most interesting of the series of railroad articles now appearing in that publication.

Among other things concerning the fraternity, he says:

"Locomotive engineers and firemen read with avidity everything which is explanatory of the construction or working of locomotives, but generally have a contempt for things which have no practical bearing. They demand 'lucidity' in what they read with as much vehemence as Matthew Arnold did, and some editors and college professors, whose writing and thinking is foggy, would be greatly benefited by the criticisms of the Locomotive Brotherhood."

Mr. Forney also pays a tribute to, and gives a reason for the success of "firemen runners." As enginemen cannot pull cars with "foggy theories," why should they not demand practical reading?

The general crops of the country are better than they have been for years. Railroading will be lively this fall and winter. No one objects.

ASKED & ANSWERED

(46) T. T. Stratford, Ont., asks.

What is the longest road in Great Britain? *A.*—The Great Northern Railway operates the most miles of any corporation in the kingdom, having 2,455 miles in its system.

(47) Shake Bar, Mandan, D. T., asks:

Where do the big engines on the Northern Pacific get their name of "Decapod"? *A.*—Decapod means ten-legged, as a lobster or crab. The first decapods built were for the Railway of Brazil, by the Baldwin Works, and had ten drivers coupled; from this fact they took their name.

(48) 3-Way, Raton, N M., asks.

How does the new Westinghouse engineer's brake valve differ from the old one? *A.*—It has a loose piston below it, that opens and closes the passages to main air pipe very slightly, thus making the application of brakes smoother, when handle is operated between certain stops on valve, but has a large free opening around this piston for emergency stops. Not being obliged to compress a heavy spring, the cock handles easier than the old one.

(49) Fireman, East Tennessee, asks:

Does the crosshead of an engine move both ways when the engine is in front gear, and to what extent? *A.*—When the engine is running forward, the crosshead travels the length of the stroke both ways as far as it relates to the engine, but with its relation to the ground it travels faster going ahead and then stands still, or nearly so, while the engine runs past it as far as the stroke. Should the engine slip, the crosshead will travel back. When your engine is starting hold a stick on the ground even with crosshead when on front center, and you will find that it does not go back past it. Practically the crosshead travels full stroke both ways.

(50) R. T., Nat. City, Cal., writes:

Please give rule for finding the length of the link, the radius being given. *A.*—The radius has nothing to do with the length of links, except as the length of blades indirectly require more length if they are so short as to cause excessive slip. There is no hard and fast rule governing link length, but the almost universal practice in this country is to place the eccentric blade pins in link a distance apart equal to 2¼ to 2½ times the throw of the eccentrics, then the link has to be enough longer to clear the die or link-block and its slip when engine is working in the corner If your upper and lower rocker arms are of the same length, the travel of the valve equals the throw of your eccentric; if this is 5 inches, about 18 inches, inside measure, is usual practice for length of link.

(51) No. 14, Savannah, Ga., asks.

Would you kindly give me a receipt for cleaning engine brasses so as to retain their color? I am a fireman on the C. & S. Railway, in Savannah. *A*—No. 14 has asked a hard question, a good deal like the one requesting the size of a piece of chalk. Cab fittings that get hot will turn color, no matter what cleaning compound is used. The best known way to clean these brasses is to use flour emery, and let them turn color. Tripoli cleans very well; use water with it, and polish with dry tripoli. Rottenstone is one of the best powders to polish with after scouring brass. Oxalic acid, diluted with about six times its own weight of water and applied with waste, cleans tarnished brass very nicely. It must be washed off at once and the brass polished with some dry powder. Muriatic acid used the same way will make the brass a gold color. Bands, wheel covers and hand rails that do not get hot are easily cleaned with any of the above, and will keep clean much longer than cab brasses. A good deal depends upon the quality of the brass itself. Very white brass keeps clean easier than hard, red brass, especially if it does not get very hot. Some of the compounds sold for that purpose are good brass cleaners.

IN THE ROUNDHOUSE AND REPAIR SHOP.

The standard railway gauge of Spain is 5 foot 3 inches.

⁂

The members of Swannanoa, Div 267, B. of L. E., at Asheville, N. C., are establishing a lodge room, library and reading room. This is an investment that will always pay 1,000 per cent.

⁂

Master Mechanic Vreeland, of the Erie, Jersey City shops, has found that engines with extension fronts steam better and throw fewer cinders when the sheet that extends from the flue sheet, above the flues, to the deflecting plate, is replaced by a strip of netting.

⁂

The overhead ventilators on the "L" roads in this city are all handled by one lever placed near the door. Why would not this method be better for surface roads than the present grab-hook system that never gets any two alike, and is a nuisance to passengers as well as extra exertion for the cranker?

⁂

We notice that on some of the roads running into this city, where they use the big driving brakes regularly, that engines having moderately thin tires often have loose ones. There were shims sticking out on several wheels we noticed. Reminds you of the days of wrought iron tire and the tri-weekly setting bees.

⁂

Locomotive building at Paterson is lively, excepting at the Grant works, where most of the men have been laid off and only a few engines for the elevated road are building. Rogers' works are crowded with orders, and the erecting shop is full of men and locomotives. Cooke's works are also very busy.

⁂

The Richmond & Danville road finds it easier to lift the stacks to clean out nozzles than to open the front end and lower netting. A place to hang a light lifting tackle over each stack in the roundhouses, and the man who inspects and cleans out fronts provided with a lift, is all that is necessary to secure good results from this plan.

⁂

Several master mechanics, in private conversation at the recent convention, related experiences with different kinds of ash pans having window-shutter arrangements in the bottom, and the verdict seemed to be that they warped out of shape easily by the heat, and in winter were easily clogged up and rendered inoperative.

⁂

A person not familiar with the facts in the case, would think, to read some of the orders posted by railroad officials, or read some of the papers of the day, that men who sit at the desks of superintendents and managers are altogether different beings than the "employes." The general manager is as much of a "hired hand" as a track walker.

One of our engineering exchanges takes up the master mechanics' discussion of extension front ends and open stacks, and, in talking of locomotives, clearly gets beyond its depth; continually speaking of *expansion* smoke arches and *extension* smoke stacks, and calling the midfeather arch or water table a midfeather tube. And yet the editor of this paper used to be a locomotive engineer—probably on a horse boat.

⁂

Master Mechanic Gentry, of the Richmond and Danville road, believes that if a thing is worth using it is worth using right. He has success with brick arches, etc., and keeps a man at each roundhouse whose duty is to inspect grates, bore out the flues and pick all clinkers, etc., off each arch every trip. Requiring the fireman to do all this is putting too much work on him, and it is not always done when it should be.

⁂

Two English inventors have gotten up a locomotive feed-water heater that goes into the fire box, in place of the brick arch, and, it is claimed, absorbs heat now wasted in heating the arch. The brick arch gets white hot and aids combustion by having the gases passed over it, and it also keeps flues from leaking when the door is opened or when the fires are drawn.

The new design may heat the feed-water, but, if it does, it loses its value as an arch.

⁂

The O. R. & N. Co. have ordered some new engines that were designed by master mechanic H. N. Webber. The engines are for heavy mountain service, consolidation, and will have cylinders 20x24, driving wheels 46 inches diameter, and the smallest ring in barrel of boiler will be 63 inches in diameter. The boiler is 21 feet 9 inches in length, has 2,160 square feet of heating surface and 25 square feet of grate surface. Engine complete will weigh 126,000 pounds.

⁂

The locomotives of many Eastern roads have small cocks tapped into sides of water tanks over each truck box, and a hose arranged to drip into a hole drilled in box covers. There must be some good cause for so many hot truck boxes; insufficient bearing surface, rough or poor material. Many locomotives are running in the West that carry almost twice the weight of water and coal that ordinary engines do, and yet their truck boxes receive little attention, and only get hot from lack of ordinary care.

⁂

All the newspapers in the world have now had their slap at the mother-in-law, and she has come out on top a loved and loving institution. The brakesman who can't call the station names in English has got about half way through the line of quills. The tramp editor kept track of the vocal ability of six different brakesmen on a jaunt, last month, and five of them called with distinctness and regularity only equaled by a bill collector. The gafter is all right; these newspaper chestnuts want to sweep down the cobwebs and fish the cotton out of their ears.

⁂

M. N. Forney, in speaking of the use of some rule to determine size of boiler, at the M. M.'s convention, said that as good a rule as he knew of was to proportion the size of cylinders and driving wheels to the work and then make the boiler as large as possible for the weight allowed and the wheel base would stand. No doubt this is the right idea. There is no use in following some set rule of grate surface to size of cylinders, and then weighing the engine down with cast-iron lagging. Weight in the boiler kills two birds with one stone—weight for adhesion and abundance of steam room.

⁂

The new engines on the Caledonia Ry., Scotland, have fire doors that open inward. This class of door is well liked in Europe, and we believe will come into use here, as, when open, it deflects the air down onto the fire and makes it possible to see just how the fuel is being burned, and also prevents smoke; it takes up no room in the cab, and pieces of coal on deck, etc., do not prevent its being closed promptly when fire is in. Mr. Rufus Hill, M. M. of the Camden & Atlantic, designed and used a door of this kind, and the only one we know of in the United States.

⁂

The general agents for Pocahontas coal, Castner & Curran, 308 Walnut street, Philadelphia, have issued a neat poster in colors, to tack up in the cab. It has, in neat, large type, full directions how to fire their coal, telling its peculiarities, and a lot of useful hints on firing in general. All coal companies would do well to furnish cards of this kind to roads using their fuel. They are a great help to men not used to the peculiarities of different kinds of fuel. Directions how to make steam with some of the lignite that is used on some sections of the Mo. P. road, and not make pig iron of grates, would be doubly welcome.

⁂

At the Rogers Locomotive Works we noticed they were lagging the cylinders with asbestos mortar as well as the boiler. This is a point that is neglected more than it should be; if, in addition to the mortar around the cylinder, the sides and top of the steam chest, as well as both cylinder heads, were lined with hair felt, we believe it would result in enough economy to pay for the extra cost many times over. This company are also putting a strong iron hoop across under the eccentric blades, just back of the links, to keep them from striking the ground and doing additional damage should they become separated from the link—a simple little precaution that will pay for itself.

⁂

The writer recently stumbled onto a mechanic who was chipping and filing a locomotive slide valve and complaining because the shop had no planer or shaper to save him the work. He was delighted, and surprised to think he had not thought of it himself, when we told him of the old scheme of making a wooden frame the shape of the valve yoke and deep enough to hold the valve, and then placing this against the face-plate of a lathe, and centering the point of tail-stock in exhaust cavity of valve, to keep the rig in place, and driving it with a bolt or stud in plate. By this simple rig a valve can be faced off in very good shape for the scraper; all of which goes to prove that there are lots of simple little kinks that are old in one locality, but novelties in another. Let's trade kinks.

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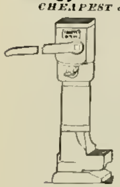

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PATENTS.

Mr Wright refers to Mr. Hedden, Rogers Locomotive Works, Mr Cooke, Cooke Locomotive Works, Mr Evans, Grant Locomotive Works.

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VOL. I. NO IX. NEW YORK, SEPTEMBER, 1888. $1.00 per Year, or 10c. a copy.

A New Piston Valve.

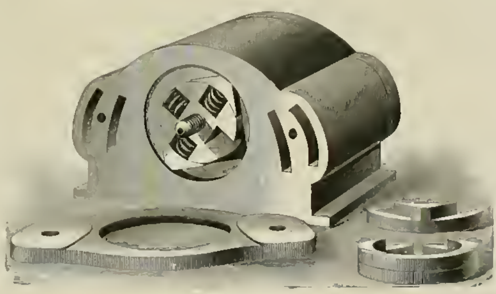
The piston valve has always been the subject of more or less thought by inventors. The perfect balance and ease of handling the engine has always been an incentive to the successful solving of the piston valve problem, but when they got into the business deeply enough they have always found practical obstacles that have made their inventions of no practical value. The chief obstacle has been that, to keep the packing rings of the valve from catching in the port and breaking, it was found necessary to make multiple ports—a row of holes instead of an open port. This, at best, is a bad device, and was alone enough to kill the piston valve for locomotives; another trouble was the proper relief of the valve and cylinder pistons, when running with steam shut off they became pumps that were constantly drawing dust and cinders into the steam chest and cutting the valves to pieces. An ordinary D valve will lift off its seat and relieve the pressure of air in the cylinder if the engine is shut off and the lever left hooked up, but the ordinary piston valve would not lift, and terrible pounding and consequent strains on entire gear were the result.

Thos. Tripp, of Boston, has recently patented and placed upon the locomotive "Onward," of the Boston & Maine road, a piston valve that seems to have successfully dodged all the difficulties on which former efforts in this line have struck.

In the first place, Mr. Tripp makes his valve and its chest go inside of the ordinary locomotive steam chest, and its stem can be attached to the present valve motion, the lead and lap of valve remaining just as it is now; the bottom of his valve case has ports that fit exactly the present steam and exhaust ports.

The large engraving on this page represents this valve case with relief plate off, with follower and one ring out of piston.

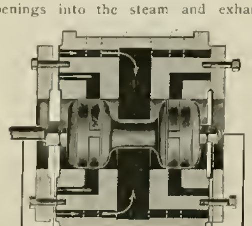
In the peculiar construction of the rings is one of the main features; there are several rings or sections of rings, but they are so made that each piece reaches across the space occupied by them all, which is wider than the open port, so that the valve with its rings travels clear across the port, giving a full opening. The construction



Tripp Piston Valve.

of the rings is shown on the right of the engraving; they interlock, and the four springs shown press outward on the wedge-shaped part of the segments, and it is plain to see that to push out one of these is to force out the entire ring; by breaking joints with these segments a perfect joint is secured.

The four long slots shown on the end of the cut are the relief passages, simply openings into the steam and exhaust



Tripp Piston Valve, Plan.

ports; these are covered by the large plate shown in front of the valve case, which is loosely supported by two bolts in the ends. While steam is in chest these are firmly pressed over these openings, as shown on right of sectional cut, but as soon as the pressure is taken off the plate drops away, as shown on the left, so that all pressure is avoided on any side of valve. These plates do not have to be removed to examine or repair valve, as it can be drawn through the large opening in the center.

The valve for a 17 x 24 inch cylinder is 5½ inches in diameter.

A moment's study of the plan view will make the construction plain. The steam pressure is on each end of the piston valve and the exhaust on both sides of the two inside heads, so that the valve is in perfect balance.

With the throttle wide open, steam pressure at 160 pounds, the reverse lever of the "Onward" can be thrown forward and back as easily as when the pressure is off. In running with steam shut off it makes no difference if the reverse lever is left hooked up.

These valves are made by the Tripp Anti-Friction Journal Bearing Co., 33 India Wharf, Boston, Mass.

An Awful Strike.

We are in receipt of a letter from a nervous gentleman, who asks us to let up and not try to have Colvin's plan of a twenty-four-hour clock adopted. He asks: "What in the name of the sufferin' Cyrus will we do when the old clock on the stairs wakes us up with its fire alarm of twenty four beats at midnight, only to be obliged to hear the bells and chimes of forty churches hammering twenty-four big welts each on a brazen monster that don't care a Continental cuss whether you sleep or not?" Maybe our correspondent can get the clock to call off its strike and arbitrate.

Many locomotives are running, especially in the East, with no provision for taking up slack between the engine and tank. The engines would ride better, and the crews last much longer, if they were provided with a good wedge arrangement.

90 Miles an Hour.

The crank with the square boiler and the ninety-mile-an-hour locomotive, built on a mathematical proportion to the gauge of the track, is still making 80 or 90 miles an hour with his scheme—in the newspapers. If it works half as well on the track as it does in the brains of the reporters, it will be a howling success.

The Boiler Explosion on the Reading.

On the first of August a Reading locomotive boiler "let go" at the 9th St. depot, killing the engineer and fireman and injuring several passengers. The engine was one of the new Baldwins, with standard fire box; and old railroad men, who have examined the wreck, inform us that it was a plain case of low water, and one of the worst on record.

The First Decapods.

We are in receipt of reliable information that even the meek and lowly editor of this journal is liable to err, the last instance being the statement that the Baldwin works built the first "Decapod" locomotive for Brazil. Our informant says that J. A Durgin, of Scranton, Pa., built two "Decapods" for the Lehigh Valley road in 1867; they were named the "Ant" and the "Bee," numbers 81 and 82. One pair of driving wheels have since been taken out of these engines and a pony truck placed at each end.

Ingenious Front Door.

Master Mechanic Thompson, of the Long Island, has many different makes of engines and many odd sized boilers, so that, to keep front end castings for all, required great expense and care. To avoid all this, he adopted a door that would go onto any boiler, and then fitted up a narrow casting for the door to swing on and fasten to. This is used for all sized boilers, and the odd sizes are fitted by the outside ring, which is made of wrought-iron. Only one sized door is carried in stock. The door and ring off any engine will fit any other engine; all that is necessary to fit to the odd sized boiler is the narrow circle of wrought-iron that any boiler maker can supply in an hour or two.

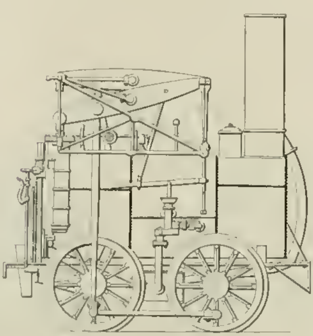
Cost of a Bridge Accident.

A couple of years ago the country was shocked by the awful calamity at the Bussey Bridge, on the Boston & Providence Railroad, in which many people lost their lives. The last claim against the company for death or maiming has been settled, all without a suit, and the Boston & Providence Co. are out on this item alone over one million dollars. This does not include cost of new bridge or rolling stock. But with all this waste of money they cannot buy back the lives sacrificed. The railroads have increased the weight of engines and cars more than double, doubled the length of trains, doubled the weight of rails, doubled the number of passengers, doubled the amount of stock, and placed them all on top of the old wooden bridges—because these bridges have not broke down before. Our railroads need more stone arches, steel bridges and stone ballast. American railway rolling stock is the heaviest and finest on earth, and we have the poorest road beds to support it. Less watered stock and more permanent ways are in demand.

Disconnectors.

When there is a break-down on the road, the way things are fixed up, and the delay caused, generally show what kind of timber there is in the engineer.

Some men seem to know just what to do to get their engine into running order, and to avoid delays both to themselves and others, while the man on the opposite run goes crazy if he gets off the track and is helpless and at sea if he breaks an eccentric strap, a piston, or a pin. A very good plan for firemen and engineers is to study every break-down that occurs on the road If Hogskin Thompson was running wild ahead of the cannon-ball and broke the left crosshead, knocked out a cylinder head, and bent the rocker-arm, put yourself in Hogskin's place and figure out how you could protect yourself and everybody else, get your engine into running order, and out of the way of the cannon-ball and opposing trains, in the least possible time, and with safety to all. If there is a class of engines on the road whose eccentrics are not on the main driver, if there is one with radial valve gear, or hook motion, look her over, talk about her, and *think;* you may have to run her some day, and she may lay down and "put you in the hole" because you did not know your business



STOURBRIDGE LION. (FROM AN OLD PRINT.)

The writer knew a youthful runner, who got to running several years before he ought to, that disconnected both sides of his engine because she would not move either way while off the track with her forward draw-head fast under a 50,000 pound car of steel rails, not a bolt broken or out of place.

We saw an old engineer walk up to a Mason-Farlie engine one day, and look long and earnestly at the Walschaert gear, when, turning to his fireman, he said:

"Bill, supposen you was running this side-wheeler, and you struck a car that didn't clear, and knocked off about half of this riggin'—what would you do?"

"Disconnect her," said Bill, promptly.

"All right, what would you take off?"

"Everything on this side but the side rod," said Bill, "or I would ask the fireman to move her and take off everything that moved. Couldn't miss it that way, could I?"

"Now, I'll tell you what I'd do," said the engineer; "I'd just telegraph in to that master mechanic and tell him to send me a general assortment of wiggle-rods and wimble-bars for his duplex side-wheelers, then I'd pick out what I wanted in place of broken ones and go on. I wouldn't let no 'ornery, dog-oned scrap like that stick me. That's the point, boy; never get stuck, never—how much wealth did you say you had? Fifty? That's the skedual boy, that's her—less eat."

Historical Locomotives.

SECOND SKETCH.

We present to our readers, with this article, illustrations of the remains of one of the most interesting pieces of old machinery in America The boiler and one cylinder of the "Stourbridge Lion"—the first locomotive that ever turned a wheel on the American continent.

There has been so much written about this engine, and so little of it was in any way reliable, that the editor of this paper decided to investigate in person, and get views of the remains of the engine, and not sketches from memory of how it looked when in running order.

It has been stated in mechanical and in railway papers that the cylinders were in use in a coal mine and the boiler in a foundry at Carbondale, but we find these statements not true

Let us begin at the beginning In the first place, it was necessary to be certain that the relics shown were really the remains of the first engine. At Carbondale, Penn., we saw the signature of Horatio Allen, the man who ran the engine on her trial trip, stating that the boiler there shown was that of the "Stourbridge Lion." Mr Allen is still alive, and has several times told the story of his first ride

Mr. Allen was a civil engineer, employed by the Delaware & Hudson Canal Co., and was much interested in newspaper accounts of trials of locomotives on the Stockton & Darlington railroad in England, and in 1828 he decided to cross the Atlantic at his own expense and see what was going on Just before sailing he was entrusted by the Delaware & Hudson Canal Co. with the selection and purchase of three locomotives.

He visited England, witnessed the trials of the yet unsuccessful locomotives, and ordered his machines, confident that locomotives would be, in a short time, the prime movers of land travel.

The Stephensons had not yet made a

success on the Liverpool & Manchester road, as the "Rocket" had not yet been built. Mr. Allen bought the "Stourbridge Lion" of Foster, Rastrick & Co., Stourbridge, and two other locomotives of the Stephensons that were the prototypes of the "Rocket," and they were shipped to New York, arriving in May, 1829, were set up, and one, the "Stourbridge Lion," was sent by canal to Honesdale, Pa., and there placed on the track—wooden sleepers with iron straps on top.

On the 8th of August, 1829, the engine was fired up, and the crowd present declared that it would not go around the curves of the road, although it had a rigid wheel base of not over eight feet. Mr. Allen had never handled any kind of a steam engine before, but he took the levers of the "Stourbridge Lion" in hand and ran her three miles into the country and returned in safety.

The engine was found to weigh seven tons, instead of four, and was considered too heavy for the track. This was the only mileage she ever made as a locomotive.

Mr. Allen says that, had one of the Stephenson locomotives been sent, he is satisfied that America would have had the glory of a first successful trial instead of England.

After this trip, the engine was placed in a shed at Honesdale, and laid there for several years, then she was brought over the gravity road to Carbondale, and side-tracked for a long time.

At Carbondale we met Mr. David Smith, a man upwards of seventy years of age, who remembers when "us boys" used to play on the old engine and admire the lion's head painted on the boiler front.

About 1834, the Canal Co. sold the old engine to John Simpson, a founder. He dismantled her and set her boiler in a brick arch, firing under the shell, and using the old fire-box flue as a smoke flue; one cylinder he converted into an upright stationary. This boiler and cylinder remained at work in this shop until 1871.

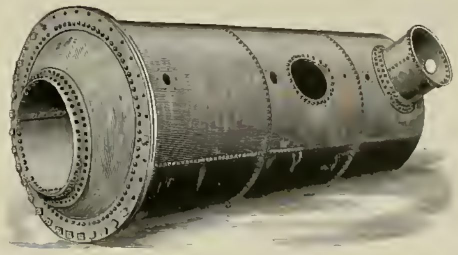
Patrick Early served his time in this foundry, and in 1869 bought out his employers, and he is now the senior partner in the firm of Lindsay & Early, stove founders, and the owners of the boiler and cylinder. In 1871 Mr. Early found that the old boiler would not make steam enough by using one ton of coal per day, and replaced the boiler and engine with modern devices, using one ton in five days.

In 1883, S Dottier, then M. M of the D. & H C Co., borrowed this boiler and sent it to the Exposition of Railway Appliances, Chicago, and there, or in transit, every flange that could be broken off with sledges and chisels was carried off by relic hunters.

The large cut shows the boiler as it now is. It is 4 feet in diameter, 10 feet 6 inches in length, the large flue shown in the back end is the fire flue, and is 2 feet 4 inches in diameter and 4 feet 2 inches long, branching out into two flues laying side by side, each 19 inches in diameter; these come together again near the front head, and a single smoke flue comes from their union up through top of boiler for the stack.

There was never any repairs made to this boiler, and it is seamed and pitted badly; it has no stays of any kind; all seams are single-riveted, nine rivets to the foot; all the sheets were of half-inch iron.

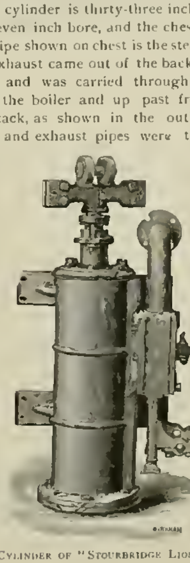
Mr. Early says that when he was a boy in the shop the safety valve often lifted with three and four times as much weight on the lever as the ball. The front head is oval, bulging out six or eight inches. There were two gauge cocks on back head, and a lead safety plug in the top of fire flue.



Boiler of "Stourbridge Lion," as it is now.

The boiler was never lagged, and will weigh about 4,500 as it now stands.

The cylinder is thirty-three inch stroke and seven inch bore, and the chest 11x11 The pipe shown on chest is the steam pipe The exhaust came out of the back side of chest, and was carried through a pipe under the boiler and up past front end into stack, as shown in the outline cut. Steam and exhaust pipes were the same size. The engine was of the walking-beam type, afterward called "grasshoppers." The wheels were of wood, shod with iron. Of the valve motion little is known—it was probably stolen off before the engine was sold for a stationary; the crosshead shown was not used on the locomotive The cylinders were bolted to the side of the boiler, not the head. All the pipe connections to boiler were made by flanged joints, and the bolt holes punched in the boiler are square; there is a large manhole on top, but no dome.



Cylinder of "Stourbridge Lion."

One peculiarity of the boiler is that it had no flanged sheets; there is an angle iron flange used at all joints, as can be seen at the joint around smoke flue, and also around the fire flue; the front head has a ring inside, and the back head has a heavy wrought ring riveted to it, and there is an angle iron flange riveted to the shell. These two are held together by bolts. These bolts were all out but four or five under the fire-box, and in 1883 Mr. Dottier put in new bolts to keep the boiler in shape. On the trip these were most all stolen out, and are, no doubt, now preserved as relics of the "first locomotive."

As might be expected, Mr. Early has had many offers for this interesting relic, but he says that he does not like to see it buried in some museum, where only a few wealthy can see it, and hopes some opportunity will present itself whereby it can be exhibited throughout the country before it goes into a national museum.

It is wonderful, when we come to think of it, that this old boiler furnished the power to propel itself before any of the 30,000 locomotives now running here were even invented, let alone being built

It is wonderful to think that the vast railroad interests of America have grown from this old hulk, and the little strap road in Pennsylvania to their present magnitude, within the life and memory of the present generation.

It is still more wonderful to think that the man who declared to the directors of the South Carolina Railroad, before even this engine was bought, that "there was not much hope of very much improving the present breed of horses, but that no man was alive who would live to see the end of improvement in the steam locomotive," and who afterward opened the first throttle-valve in America, should be alive and well to-day, and able to contemplate the vast growth of the age of railroads that sprang from the germ he furnished when he turned the steam onto the "Stourbridge Lion," August 8th, 1829.

The Westinghouse Company have "absorbed" the American Brake Company of St. Louis This puts the new air brake into the hands of the Westinghouse people; there has been considerable hope expressed that the new brake would be a lively rival of the automatic, but it seems that we have heard the last of it. The American Brake Company will still manufacture their steam driving brake, the Westinghouse Company guaranteeing a certain percentage in dividends on their capital stock.

The Dean Guide.

We are in receipt of a letter from Mr J. W. Dean, of Cambridgeport, Mass., inventor of the Dean guide, confirming the statement made by Mr. Lauder, before the Master Mechanics' Association, that an engine equipped with this guide had been in active service for over five years without any perceptible wear Mr. Dean also says that, to all appearances, the guide will run ten years more without lining up.

If some company would manufacture this guide and guarantee a service of five years without lining up, it seems to us they could do a land office business, and get big figures for their work.

On the Right Track.

The engineers of Truckee Div., No. 158, at Wadsworth, Nev., have invested $250 in a fine, Richardson valve motion for their lodge-room. There will be more of this in the next five years than there has been in the past twenty, and it is well that there should be Some day the officials of the roads will decide to hire or promote men on competitive examinations only, and they will find the men ready. Other States may take a notion to follow the lead of Alabama, and require locomotive engineers to pass an examination and carry licenses—if they do, they won't have to import engineers.

The Tootophone.

An inventor has patented a device to which he has given the above name; it is to register the number and length of all steam whistle signals blown, and is expected to settle all disputes as to whether proper whistle signals were given in case of accident. On locomotives, tugs, and river and harbor crafts, it is expected to do considerable good. This may seem to be another foolish invention, but it is much better than the average, and if in use would do away with many disputes as to whether proper signals were blown or not, and where the officials must take one man's word and not the other's; the tootophone will only tell the truth, and the truth won't hurt anybody. We would rather have a pair of toot registers on our smokingine than a spotter that lies about the toots, or a spark arrester that prevents raising steam enough to toot with.

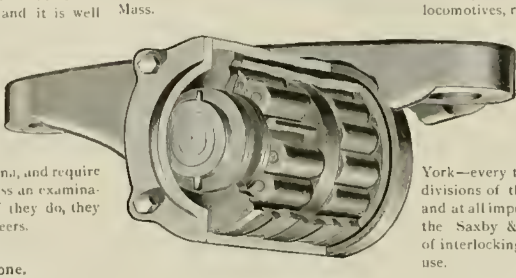
The Tripp Roller Car Journal.

We illustrate herewith a new form of roller bearing, designed for car service that seems to have overcome some of the difficulties encountered by other bearings.

The main trouble with roller bearings has been that, as soon as the outer case was worn away at the top, the loose rollers did not crowd up so that they were in line with the axle. In the Tripp journal bearing the rollers are short sections of steel tubes, and are all mounted on pins inserted on each side of a ring; the rollers at the top keep the ring in motion, and it brings up the rollers from below always in time and in line with the journal. These rollers run on a sleeve on the shaft, and not on the shaft itself, and on a ring in the box, and not on the box itself. It will be seen that, by this arrangement, those details, and not the expensive parts of a journal bearing, like a box or shaft, will be worn out. The collars on outside of shaft that holds the friction rings in place are provided with pressed paper gaskets, and the method of packing to prevent oil from escaping from box is fully shown in the engraving.

These bearings are designed for any kind of a car, and have been tried on one of the street car lines of Boston, showing a very light draft. The makers guarantee that they will run, in any service, one year without oiling.

For further information, address Tripp Anti-Friction Journal Bearing Co., Boston, Mass.



The Swinerton Locomotive.

When the Swinerton Locomotive came tip-tapping along with 105 flat spots and 41,000 pounds on her single pair of drivers, this paper was taken to task by some of the Boston stockholders for condemning a "new departure in locomotive practice before it could be tried." So we agreed to keep still for six months, which we have done.

We have watched this engine's performance, and find that she has spent as much time on the jacks as on the road, that her flat spots have got their corners knocked off, and that she has never made twenty-five miles at a stretch without getting her driving boxes too hot for safety. She has had some of her weight transferred from the drivers to other wheels, and new axle and driving boxes.

The engine was built in direct defiance of two well known laws of mechanics—the inventor claiming that increasing the area of the surfaces in contact increased the adhesion, and that he could carry much more weight on a single pair of driving wheels than exhaustive experiments had shown could be carried. In both of these attempts he has failed. For long runs, or fast runs, when there is more than 15,000 pounds on each driving box, it will be found a tender spot.

Much interesting correspondence is crowded out of this issue.

The Bazoo Car Heater.

An escaped lunatic, or his equivalent, has patented a car heater that goes at the problem in a new way. This inventor extends out in front of the locomotive a pipe having a large bell mouth; this pipe extends through the boiler in a zigzag line, and it is expected to thus heat the air that passes through this pipe, and warm the cars by hot air. As quick as the merits of this device are thoroughly known, it is more than likely that steam car heating devices will be for sale cheap, and stoves can be had for hauling them away.

Novel Features of the New Long Island Locomotives.

To the majority of railroad men the Long Island Railroad is an unknown quantity, and generally considered small, yet it does an important business.

The Long Island is a standard gauge road, 356½ miles in length, and using 120 locomotives, running over 800 trains daily; of these less than a dozen are freight trains, the rest being passenger trains During the busy hours, from 6 to 10 A M. and from 3 to 7 P. M, trains arrive and leave Long Island City—opposite New York—every three minutes. Most of the divisions of the road are double tracked and at all important stations and junctions the Saxby & Farmer (English) system of interlocking switches and signals are in use.

To successfully handle so many passenger trains the system of orders and signals must be good, the motive power must be kept up, and the locomotives must be manned by first-class men. The Long Island seems to have all these requisites.

The road is an old one, and of course has some old engines, but these are mostly used for switching purposes and light runs.

Master Mechanic C. A. Thompson has been in charge of the motive power for more than 21 years; he was formerly an engineer, and the handy devices found on his engines show that he knows what is needed. The Long Island is one of the pioneers in the use of extension fronts, having used them 14 years.

The Rogers Locomotive Works, Paterson, N. J., have recently built a number of locomotives to Mr. Thompson's designs that have some novel features, especially to engineers. On page 5 will be found a cut of the cab of these locomotives, and the Long Island engineers think they are as good as the best

The engines are 8-wheelers, and the engineer's seat is about midway between the driver's, and higher up than on ordinary 8-wheeled engines; the cab proper is made of wood, and has no projecting roof behind, and sets far enough ahead on the boiler to let the latter project out behind it about three feet; this brings the dome up through the cab, and behind the engineer; he is up on the wagon-top, and can see across the boiler much better than of old; it has been found that the engines ride much better at this point than at end of boiler.

Bolted on behind the cab is a hood of iron, covering up boiler head and extending over gangway, to protect the fireman from storms; its roof slopes toward the other cab, and at the apex has a ventilator that carries off all smoke and gas. Immediately under the dome there is a water glass, with self-closing cocks; in front of the engineer there are three gauge cocks, and there are also three on the back head, for the fireman's benefit, and to keep night men, watchmen, etc., from going into cab to try water and smoking up everything with their torches. The throttle is convenient, and the lever that handles the Luttgens damper, in the base of the stack, is immediately under the throttle. Of this damper Mr. Thompson speaks very highly.

There is a steam gauge on the boiler head for firemen, as well as one for the engineer. Two Hancock inspirators are used, and are placed in convenient positions.

They use the Westinghouse or Smith vacuum brake on cars, using the regular Westinghouse air couplings on hose, and have two lines of pipe and hose running through trains, and two accordion cylinders, attached to alternate trucks. On the engine are used two Eames ejectors to produce a vacuum; they are in front part of cab and connected by levers, so that in applying or releasing one both are operated; they can be handled from either side of the cab. With this arrangement one-half the brakes can fail, and yet the train be under full control, and by using two ejectors they get a very quick application and a quick release.

As will be seen, the windows on either side of the cab are very large and roomy, the sash sliding both ways and fastening together in the center—by this plan the runner can make the size of the window fit the weather.

All steam connections in cab come out of a turret located on top of boiler and between the brake ejectors; this fountain has a main valve that shuts off steam, or in case it is broken off closes automatically.

Another novel feature of these engines is the manner of hanging the driving springs to the box. Fig. 2 shows the plan adopted; it consists of four heavy flat hooks, that hook into pockets cast on top of the box and are joined together at bottom as shown; over the pocket formed at the bottom by the four hooks is fitted a cast-steel shoe that supports the driving springs. This arrangement does away with the bolts in bottom of box, admits of a larger cellar, and is easier to repair than the old style.

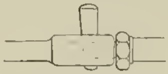
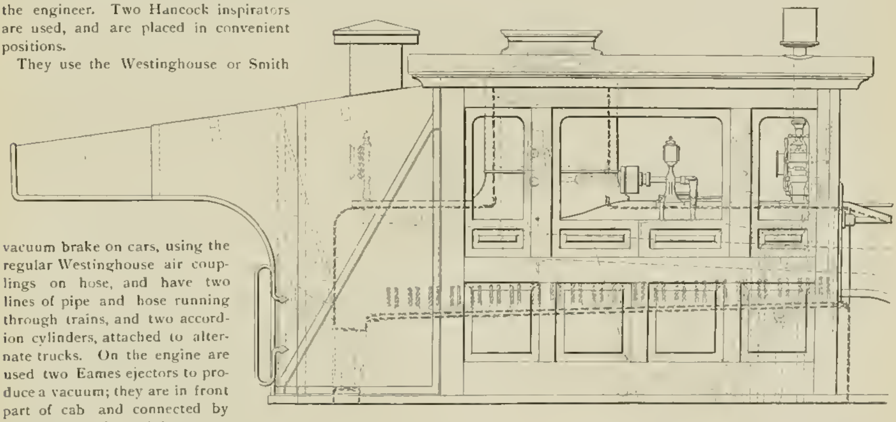


FIG. 3.

Another nice little trick is shown in Fig. 3. Every engineer who has had to disconnect a valve rod from the stem knows that in about nine cases out of ten the fit has rusted fast—there are coal-pick marks on 11,000 valve stems in this country attesting to this fact. Mr. Thompson puts a nut ahead of the union, and abutting against the rod sleeve; a single turn of this nut will force the connection apart. This is one of those little things that some people call "traps," but they save delays and dollars, even if they are made "especially for engineers."

The engines have cylinders 17x24, using a solid head and three rings, Richardson balanced valves, Laird guides, and solid-ended side-rods of I section.



CAB ON LONG ISLAND LOCOMOTIVES.

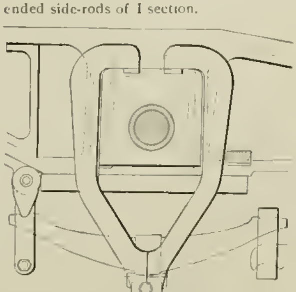


FIG. 2.

The crank-pins are hollow, having a brass plug screwed into the outside end and small holes drilled through to face of pin; these hollow pins are filled with cold tallow, and on the least inclination to heat they get tallowed automatically from the rear.

The engines have light iron pilots and are finished with brass, notably the cylinders, wheel covers, hand rails and running boards; the paint is all black except a light stripe on wheel centers and bumpers. They present a fine appearance. On the older engines the jackets are painted black; they look as well as the Russia iron, do not rust and require less cleaning.

The ash pans have three pockets, slides are connected together. The tender has no brake beam behind it, in the way of coupling to other engines, etc.; the top of the tank slopes to the center, so that the coal on back end of tank comes to the fireman and not the fireman to the coal.

These engines have iron-clad running boards, to prevent broken rods, etc., from reaching the men. They have good seats, good arm-rests, and ample room for men's dinner pails and store clothes. Mr. Thompson is very proud of his enginemen, and says they are contented, careful, competent engineers and firemen, and that it is impossible to successfully handle an important traffic with any other kind.

A Crew of Honor.

The Pennsylvania Railway officials did a neat and appropriate thing when they selected the train crew that were to take the remains of General Sheridan from Jersey City to Washington. The entire crew served under General Sheridan in the civil war. The engine, the 705, was in charge of engineer Jos. Kelly and fired by Jos. Rude; Wm Branson acted as conductor, Samuel Craig as brakeman, and H. Heberton as baggage master. It was indeed appropriate that men who once rode in Sheridan's historic cavalry should be selected as the pall-bearers in the long railway march of their commander's funeral train.

We welcome to our columns Clinton B. Conger, Mechanical Engineer, Board of R'y Commissioners of Mich.

Correspondence

Travel of the Crosshead.

Editor The Locomotive Engineer

In the August number of your paper, on page 11, is an answer to "Fireman" of East Tennessee, who asked, "Does the crosshead of an engine move both ways when the engine is in front gear, and to what extent?" This answer, while in the main correct, yet is in error when it says, "and then stands still, or nearly so, while the engine runs past it as far as the stroke." This could be true only if it were possible to have a wheel whose circumference was no greater than the full stroke of the piston. By full stroke I mean the forward and backward motion added. Thus, for instance, if a wheel had four feet circumference and two feet stroke, making four feet full stroke, back and forth, when the piston left the back center in forward motion it would move ahead (as related to an object on the ground) four feet, till it reached the forward center. Two feet of it would be the stroke, and two feet of it the result of the rolling wheel. From this point (forward center) till the back center was passed, the piston would stand still, to take another four feet jump in going over the top, and so on. But it is evident that a wheel having two feet stroke must be more than 4 feet in circumference, and therefore, in ordinary practice, no crosshead or piston "stands still or nearly so," but they will move ahead with different rates of speed. Take a wheel say twelve feet in circumference, which would be a trifle less than four feet in diameter. For every half revolution of the wheel the engine will move six feet ahead, and twelve feet for each whole revolution, but the piston and crosshead do not move with the same uniform speed, for in passing from back center to forward center the piston and crosshead move six feet with the engine, and also the length of stroke ahead of the engine, and with a two foot stroke the crosshead would move eight feet in this half of the revolution, but in going from forward to back center, the engine travels ahead on the piston and crosshead two feet, and while the wheel rolls six feet the two feet which the engine has gained leaves but four feet of movement for the crosshead, but, as eight and four make twelve just as surely as six and six, we find all parts in the same position as at first. In the case referred to, therefore, the piston does not stand still, but advances continually with greatly differing rate of speed, it being twice as fast in passing over the upper half of the wheel as it is while the pin is passing under the axle.

VULCAN.

[Correct, Vulcan; have su'thin.']

Feed-Water Heaters.

Editor The Locomotive Engineer

Are you not a little hard on new inventions? Sometime ago you done up feed-water heaters in a way that, to say the least, was rather convincing; but have you examined into the merits of the new device that simply forces the feed water through a system of pipes surrounded by the exhaust? Is this taking necessary heat out of the front end?

St. Albans, Vt. G. M. BOY.

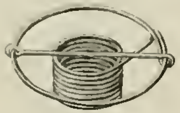
[We know of no new invention such as you speak of; the idea of forcing the feed water through a system of pipes enclosed in a box open to the exhaust was invented in 1859 by Wm. S. Hudson, of the Rogers Locomotive Works; it was given a long trial and abandoned. A feed-water heater on a locomotive doing less work than she was capable of might save a little fuel, but numerous experiments have satisfied many able researchers that they would not pay for maintenance, let alone first cost.]

Wool Holder for Link Blocks.

Editor The Locomotive Engineer

When I read that article on Link Blocks, by J. Alexander, I concluded that I had just the thing he was looking for to hold the waste in the block and lubricate the sides of the link.

I make a coil of spring wire like the sketch, and spring the smaller coil into the counterbore or oil hole in the link, and allow the larger ring to hold enough under it to lubricate sides of link. I have



made many sets of them, and they are in use here on the Alabama Great Southern road, and if the boys don't let up I will have to quit firing and start a factory. They will remain in place all right, but can be instantly removed by the fingers. I send you a pair, which please forward to John Alexander, with the best wishes of

Chattanooga, Tenn. J. R. DOWD.

They Help Themselves.

Editor The Locomotive Engineer

I have been a constant reader of THE LOCOMOTIVE ENGINEER. On its start I felt very doubtful of its future success, thinking that the field was already more than filled. But I cheerfully admit (although I take and have access to eight different mechanical and railroad periodicals) that I have already learned to take a deep interest in reading it, and feel that it comes nearer home to the real needs of locomotive men than any publication that I know of. And I predict for it, if carried on on the same practical, common sense principles, success unbounded.

At Como, the district terminal of our road, is located the Union Pacific Employes' Library Association, No. 1, of Colorado. It is supplied and maintained by the company. Employes who desire membership pay 50 cents per quarter dues.

It affords the boys spacious rooms, well warmed and lighted; a large collection of the most desirable books for railroad men; quite a list of daily, weekly and monthly periodicals, games, writing material, etc. It is just such a place as railroad companies ought to encourage more, and men ought to patronize more than they do. Some of the boys conceived the idea of building a model, showing the workings of the locomotive valve gearing, showing the effect of displacement of parts, or distortions of construction. Our librarian, Mr. C. C. Moritz, who is an expert mechanic, and skilled in the use of drawing tools, made the drawings on a scale of three inches to the foot of a standard American engine. I was to do the iron work, and the boys were to chip in to pay for material. We had the work fairly begun, when Mr. M. F. Egan, our Div. M. M., found out what we were at, offered to complete it at the company's shops, after our drawings. I think if railroad officials would follow Mr. Egan's example by encouraging such things among their men, that it would be money well invested by the company. The men would be more valuable, contented and skilled in their business, and the company receive better service.

I may, if you desire, in the future, tell you more in detail of our model.

W. W. HALL.

Denver, Col.

[Come again, Bro. Hall; this is the kind of work we like to see and encourage. Can't you send us a blue print of that model?]

Air Brake Abuses.

Editor The Locomotive Engineer.

Have been reading with interest the article on air brake practice in August number. We can't just agree with one statement we find in it. that the reduction of air pressure necessary to make a stop depended on number of cars in train, rate of speed running, and kind of grade approaching stopping place. This is all right, except that part relating to number of cars.

We would like to know what difference the number of cars makes as to the reduction of air pressure in train pipe to make a stop. On a train of twenty cars it is necessary to exhaust more air than with five or ten, but the amount of pressure need not vary. We claim this on the ground that in each case all things outside the number of cars are equal.

We recently took a few lessons in an air brake school car, and there learned several things we were not aware of before. If all engineers who have the handling of the automatic could have access to these cars, and would profit from what they learn there, we are sure there would be less complaint about the rough handling of this, one of the best appliances ever placed on rolling stock.

Some other time we want to write of some things we saw in the school car. If all who read the articles in the ENGINEER would follow the suggestions there they would be greatly benefited. There are too many men to whom it makes no difference how they do a thing, just so they get there at last; and in the use of the air brake we can find plenty of illustrations. Not long since we were deadheading over the road, and a gentleman whom we were conversing with remarked that there was a great deal of difference in engineers handling trains. He said this when the engineer, in stopping, made everyone bow to the ones in front, and in starting would start the rear coach first. There is no necessity for this. The brakes are so made that, with a little care on the part of the ones handling them, there need be no complaint. H. S. H.

Denver, Col.

A Leaky Throttle.

Editor The Locomotive Engineer.

It is astonishing what little things on an engine will sometimes make no end of trouble. I remember we got a new engine and she was troubled with the diabetes or gravel. If she stood ten minutes or more there was a pool of water under the cylinder cocks, and if she stood long the engineer would shut them to save the water, but the cylinders, steam chests and pipes got full. We decided there was a leak in the throttle, so the boys took the dome off and hauled her out and scraped and ground for half a day, and we decided it was tight, and put it in again, but still the leak was there. So we decided there was a leak in the dry pipe, either in joints or rivets. So the first chance out came the dry pipe, but no sign of a leak could be found. To make sure, we made a long ⅞ rod, put a nut on each end, and put it through the dry pipe. A 2-inch piece of pine board with a hole in the center was put on each end and the nuts drawn tight. A piece of ¾-inch pipe was screwed in one end and the test pump attached, and 100 lbs. pressure put on, but no leak. The joints were re-ground and all put in with the greatest care, but when steam was up the leak was still there. What to do next was what got the boys, until some one suggested that perhaps the bolting of the throttle pipe to the inside of the dome might draw the throttle seat out of round. So the next chance we got the dome was taken off and some red lead put on the valve and tried in; and "there lay the divil," as the boy said, pointing to the bottle as his father lay dead on the roadside. It was scraped and ground in its place and that ended that trouble. It was badly fitted to the dome, and the bolts sprung it out of round.

Another trouble with many of the heavy engines is, the steam pipes or passages have a low place, where, if there is any leak, the water settles, and will get full up to the valve face, and as soon as the throttle is opened the rush of water often starts the joints, knocks down packing, throws water out of the stack and all over the jacket and cab. We tried to cure one of these sick kittens once. We tapped a 1-inch pipe into the lowest part, above the pilot truck on each side, and led the pipes to a reservoir 12x6 inches at the back of the cylinder saddles. A 1-inch cock was put in the bottom of this reservoir and piped through the frame to near the back cylinder cock. The handle of this 1-inch cock was connected with the cylinder cock rod, and when they were opened this drain cock also opened, and the reservoir being the lowest, drained the pipes.

The sense of touch is very important to the engineer as well as to the blind man. At night he may often, by his feet on the foot-board, detect a broken wedge-bolt and wedge down, or a loose key in a connecting-rod. When locomotive inspector I often found cracks in connecting-rods on the lower side that I could not see, and no doubt saved many a poor fellow from being elevated. If there is a crack, the constant vibration will raise a small ridge on each side of the crack. I would advise engineers to make it a rule, firemen, too, as they oil round, to run the hand over the rods. Valve stems and the spokes of driving wheels ought to be run over every week. "A stitch in time saves nine."

Watertown, N. Y. J. J. Bingley.

Valve Motion Stickers.

Editor The Locomotive Engineer:

Referring to your August issue, your article on setting slide valves stops just where I hoped to gain some information. You say, "If the engine is well designed" the travel of valve will be right at an early cut-off, the same as at full stroke. I have found many engines that could not be made to show equal travel over each part with lever at different points of quadrant, by changing lengths of eccentric rods; that is, if the valve was divided right at full stroke, it would not be right when the lever was cut back, the error increasing as the center of quadrant was approached.

Please give me information on this point, and oblige

Wilmington, Del. "A Reader."

[The radius of the link and the point of suspension being wrong are the most common reasons for the trouble noted. We would like to hear from correspondents on the best remedy.]

Breaking In Engines—Modern Shop Practice—Lead Bearings.

Editor The Locomotive Engineer:

I notice in your interesting August issue an item referring to our practice in "turning out" engines which require little "breaking in." In this matter you will undoubtedly recall that it is but a few years since when a regular course had to be gone through to reduce an overhauled engine to a proper sense of duty. Today it is no uncommon thing with many, and the regular practice with us, to put the engine *at once* into regular service, without any preliminary trial trips or switching in the yard, the engines starting off and giving absolutely no trouble in any way. The reasons for this are to be found in the difference in the manner of doing work now and a few years back, and principally to the abolishment of the "scraper."

A scraper fit means a close, accurate fit, and such fits mean excessive friction until the bearing faces have obtained elbow room by the "breaking in" process. Now it seems rational *not to* inoculate the engine with disease and force it to go through a preliminary bout with the same to reach a state of good health. The first step is to do away with the "scraper" and to put up all work with sufficient original freedom. You may just as well give the engine this freedom at first, because she will help herself to it any way. On side rods having keys and main rods, we bore out the brasses two thicknesses of Russia iron larger than the pins. One thickness of this iron is placed between the joints of the brasses before they are bored out in the strap. When "put up" this leaves the horizontal diameter of brasses one thickness larger than the pin, and the perpendicular diameter two thicknesses larger. This latter enlargement prevents the brasses closing or nipping on the pin, and the rod runs cool from the start. The brasses "go up" just as they come from the lathe. The driving brasses have a little fitting done with file only.

Eccentric straps are bored out similarly to rod brasses, using heavy tin in place of Russia iron. The slight "oblonging" of brasses and eccentric straps is an important element in starting them off cool. No scraping is done on eccentric straps. Rocker arms are put up so they may be given a whirl by hand, before connected, and revolve three or four times from the impulse.

When solid engine truck brasses were used and bored out they were a source of continual grief, as we all remember. The principle of using a soft metal like lead, hardened with antimony when necessary, and letting the fit be made by *pressure* in place of by a mechanical fit, is capable of wider application. As before stated, a solid *bored* out engine truck brass is certain to run hot.

But if the brass be taken as it comes from the sand, having a dove-tailed recess cast in its crown, two inches wide, running the full length of the brass, and this recess be filled (by casting) with six to eight parts lead to one of antimony, the filling projecting three-sixteenths of an inch from the brass, with generous oil holes through it, it may be set down as an assured fact that such brasses will run as cool as can be desired. The filling is soft enough to "flow" by the pressure to a perfect fit with the journal, thus getting the desired results without mechanical aid. Metallic piston and valve stem packing is generally made of hard metal, requiring to be bored out. But if an ordinary stuffing box and gland be used a metallic packing, having all the virtues of the several patented devices, and at a cost of 50 cents for the engine, lasting eight to ten months, may be had, if the principle of "fits by pressure" be taken advantage of. The writer has used with greatest success coned lead rings, a piece of rubber hose being first placed in the stuffing-box, like a sleeve, the rings coming inside of this. The rubber gives the slight spring necessary. A swab or oil cup must of course be used on the gland, as all metallic packings require constant lubrication.

Engineers, as a class, are a "set" class of men. There are exceptions, of course. New ideas are not taken to kindly An engineer who has been used to making 10 to 15 miles to the pint of oil will at once say it is impossible to make a greater mileage. Why? Simply because he believes what he says. But fit his engine with needle cups, set them before putting on, so that they will drop two to three drops per minute; give him cans with spouts having but one-sixteenth inch holes, insist that he run ten miles beyond his usual station for oiling before he takes a can in his hand; ten miles further the next trip, and so on till he is running his engine 50 to 60 miles without the smell of an oil can, and that engineer will go on and improve his oil record till he shows 35 to 45 miles to the pint of oil. It requires an effort to get the man out of his rut, but once out, and he will in nine cases out of ten say he never could understand how he once believed 15 miles to the pint was all that could be done on *that road*, when he is now running twice that, etc., etc. If the tender trucks be packed with wool, from one to two quarts of oil a month will suffice for the whole tank, *provided* the dust guards are good and the packing be stirred up every two or three days and kept in contact with the journal by new packing placed *under* the old. Hot tank boxes are then the exception. Wool is undoubtedly the best material to pack tank, driving box and engine truck-boxes with, because its natural spring keeps it in contact with the journal. Where a railroad allows nothing but cotton waste for this purpose, the engineer should, for his own comfort, buy a pound of wool and have a little of it under the journal. Cotton waste soon becomes soggy and lies as flat as a gob of mud in the bottom of the oil box.

FRANK C. SMITH, M. M.

Mattoon, Ill.

Gentry's Oil Mover.

There are few railroad shops in the country, especially on roads using air brakes, where there is not now a system of pipes and a pressure of air. It is used to fan fires in cold engines, run drills on boiler work, test brakes, etc., and the longer the air is around, the more uses it is put to, and the more money it saves.

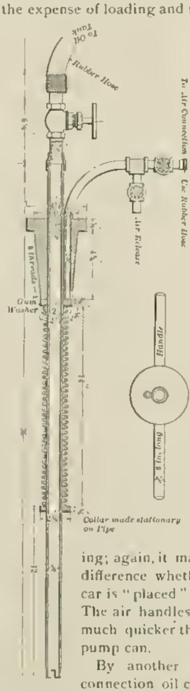
T. W. Gentry, master mechanic of the R. & D. division of the Richmond & Danville road, uses it for many purposes, and is the inventor of the tire heater that uses gas from crude oil forced through a system of pipes by an air blast—the device was shown up in these columns.

It was the custom at Mr. Gentry's shops to buy engine, signal and coal oil in barrels and pump them into large tanks at the oil house. The old plan was to pump, or elevate the barrels above the tanks and let the oil run into them by gravity—either plan is common practice, but requires lots of strong and ignorant labor.

Mr. Gentry now handles all the oil by air pressure. He drew up a plan of a barrel attachment and had one made, and the device is herewith illustrated.

As will be seen, there is a taper plug threaded to screw into the bung of any barrel; this plug carries beneath it the extension pipe that is made to go to within ¼ of an inch of the bottom by the coil spring; on the right is the air opening to the barrel, and above the plug the air hose connection. The plate above the plug carries two handles, as shown in small figure, to enable the manipulator to screw it into the barrel.

By using long lines of hose it is no inconvenience to handle oil from any out-of-the-way place, the cellar to second story or vice versa; indeed, it is the practice at this shop to empty the barrels of oil without removing them from the car, thus saving the expense of loading and unloading; again, it makes no difference whether the car is "placed" or not The air handles the oil much quicker than any pump can.



By another special connection oil cars can be loaded and unloaded in the same way.

Pressure can be applied to the large tanks in oil house, and the man in charge won't have to pump, dip or swear.

The cleanliness, efficiency and economy of Mr. Gentry's plan is enough to recommend it to any railroad master mechanic.

The sizes are all given on the drawings here shown, and any mechanic that can get to the scrap heap and a lathe can make one in a day. Mr. Gentry finds that, with any oil that will not move with 40 or 50 pounds of air, it is perfectly safe to knock the hoops off the barrel and send for a man with a shovel.

Some of the Wabash engines are "Black Marias" in the fullest sense—even the bell is painted black.

A Poor Steam Gauge, a Poorer Engineer, and a Progressive Fireman.

Editor The Locomotive Engineer

August number here and very interesting. I desire to ask you two questions. I have fired this locomotive three years and four months, and when I tell you it is the only locomotive I have ever had any experience with I trust you will attribute my ignorance to that fact.

1st What is the cause of a steam gauge getting light, *i. e.*, showing less pressure? The gauge on my engine (an Ashcroft) has been in use about one year. About a month after it was put on I noticed, when starting my fire, that the pointer stood at 5 lbs., and it has been growing lighter (if that is the proper term) all the time, and now (Aug. 5) the pointer indicates 95 lbs (the engine is cold). To-morrow the pointer will get around to 200 lbs. and then not blow off, as the pop is set at 110. Will running a boiler over frequently affect the gauge? My engineer runs her over daily, frequently three and four times, sometimes so much so that he lets the water out at the blow-off cock.

2d. This engine is supplied with a Hancock inspirator. Do you think it right to leave the throttle open when not working water into the boiler? My engineer leaves the pressure of steam on the inspirator all the time, and there is a cloud of steam coming out of the waste-pipe continuously, and grows worse daily.

E. C. SEVERSON, Fireman.

Chumuckla, Fla.

[The usual reason for a Bourdon (bent tube) gauge getting weak is because the tube gets hot, generally because there is no coil or trap in the steam pipe below it; when there is such a pipe, water, and not dry steam, comes in contact with the spring tube. If you take the hand off your gauge when the engine is cold, and place it back to 0, it will not be far from right The proper way would be to test it by a good test gauge. Perhaps the pop might be wrong.

If your engineer is in the habit of flooding the boiler three or four times a day and filling up until he is obliged to blow off, he is unworthy the title of engineer. We doubt if such work injures the gauge, but it strains and cuts and ruins a locomotive, and gives a fireman plenty of hard work cleaning. 2d. It is customary to leave globe valve open on inspirators. If the slide valve under the top cap (next to steam pipe) is tight, it is your check that is blowing at overflow; if it is the check instead of main valve, the instrument will be slow to start. From the observing and inquiring tendencies shown by this young fireman, we are inclined to think he will eventually make a sensible engineer. He is certainly entitled to a better pattern than the high-tide gentleman on his right.]

Geo. L. Perkins, treasurer of the Norwich & Worcester Railroad, celebrated his 100th birthday on Aug 5th. Mr. Perkins has been in his present position continuously since 1838. Some people think railroading is unhealthy. We should like to see a freight brakeman 100 years old ourselves.

Hot Axles.

Editor The Locomotive Engineer:

Hot axles, next to a poor steaming engine that can't be cured, give an engineer more annoyance than any other difficulty of a fast trip.

For the engine trucks, if a piece of old carpet or blanket—either is good enough if it is all wool—is cut off as wide as the inside of the truck cellar is long, and long enough so that when rolled up in a tight roll two rolls will just fill the cellar, and lay one each side of the journal, it will save lots of trouble and packing on the road. The advantage of this way is that the woolen carpet will soak up full of oil and keep the journal well oiled all the time. Then, as it is elastic, as fast as one thickness of carpet is worn through a fresh surface comes up against the journal. If the cellar is down from the journal, as they are certain to be after the brasses are worn, the packing cannot come out, as the whole roll will not string out a little at a time, as waste does, and when it wears down so the packing is not snugly against the journal, put a small roll in between the other ones and it is all right for a long time. If the holes for the bolts through the truck-box and cellar are worn large, get new bolts made that will fill the holes tight and make a good job of it in the shop, so you won't have to do anything to it on the road. Take a small bucket of slacked lime along with you and use that freely in packing hot journals.

While hot truck axles are scarce on roads where the ballast is good, steel smooth, and money enough is paid for brasses to get good ones, yet lots of runners who whale away over muddy roads, poor track, poorer brasses, and no brains at the head of the department to manage affairs, smell something hot every trip.

There have been several very good items about defects in air pumps, and the last one hits the fact about the trouble with most of them, viz.: the steam passages somewhere are stopped up. On one road they follow the practice of reducing the size of the exhaust pipe so the steam cannot get away from the pump freely "so it won't pound," and then they turn on the steam full head to keep the air pressure up to sixty pounds, when half of the live steam is used to force the other half out into the smoke arch. Their pumps last about as long as anybody else's, but they don't pump half as much air. There are a great many air pumps that won't go very well, but never a one of them but what had a good excuse for its poor work. Where every Tom, Dick or Harry is allowed to monkey with the air pumps the trouble is on hand all the time, but where one intelligent thinking man has charge of them all, he can "get onto" the disorders of the air pumps in a much shorter time, and fix them so they will work O. K.

In the August number you notice the fact that on some of the engines running into New York city, where the driver brake is used on thin tires, that the tires show signs of stretching and getting loose, but you do not say whether it is on account of the brake or thin tire. There are a great many steel tired wheels running under coaches and tenders whose tires are much thinner than is safe under a locomotive, and subjected to very heavy braking service at every stop, and they don't get loose. Why is it?

C. B. CONGER.

Lansing, Mich.

[Most coach wheels that have come to our notice having thin tires, had a flange on the inside that was bolted to the web of wheel.]

Metallic Packing for Air Pumps.

The packing here shown is the invention of Peter Dufresne, a machinist in the Connecticut River Railway shops at Springfield, Mass. It is placed in the present stuffing box in place of the fibrous packing and loose gland, the present nut holding it in place; the coned lead rings only come in contact with the rod; it is not touched by hard metals. The packing is simple, and saves lots of trouble on the road, and the scoring of rods by hard, dry packing. Its construction is easily understood from the cuts. The device is in use on a number of engines on the Connecticut River Railway, and giving entire satisfaction. It can be seen there, or further information had by addressing the inventor.

Air Brake Practice.

BY J. E. PHELAN.

In treating of air brakes and general practice it should be remembered that one kind of service should not find a place in the reader's mind, but general practice be considered at all times. General practice includes bob-tailed passenger trains of two or three cars; heavy passenger trains of nine to fifteen cars; freight trains with old style triple valves, ten to twenty-five cars; old style triple valves, and new style quick-acting triple valves, mixed in working freight trains, and the full train of fifty cars, more or less, equipped with quick-acting triple valves. The principle of practice most successful with all will be found in aiming to secure the best results with the least amount of air, excepting for emergency stops or to avoid accident. The lighter the reduction to apply brakes the better the results in even work.

A serious fault in applying brakes in general practice comes from engineers lacking confidence in their brakes, and not knowing what to expect when a certain reduction in pressure has been made from train pipe.

Engineers should allow sufficient time and distance to insure safe and gradual stops. Those who reduce pressure in quantity to force brakes to apply abruptly, so that a sudden slackening of speed is felt, are always having trouble and using more air than the ordinary pump can supply.

If the engineer reduces a certain amount of pressure from train pipe, allowing it to flow out evenly and gradually until three to five or eight pounds have been reduced, he should then blank his engineer's valve and wait with confidence the gradual slackening of speed that must follow if brakes are in good order. Care in this particular should be especially exercised in handling a mixed lot of air equipment, where old style and quick-acting triple valves are in use with old style engineer's brake valve. Where an engineer is careful and very cautious about reducing pressure from main pipe to apply brakes of both kinds, good results follow. But if the engineer's brake valve is tackled suddenly, and a large quantity of air let out to apply brakes of quick-acting and old style triple valves mixed, the train comes up standing; air has gone from train pipe, air gauge indicator dropping 15 to 25 pounds in addition to that escaping through engineer's valve, and the uninformed for the moment don't know where air has gone.

In this particular it should be understood that the quick-acting triple valve and old style triple valves act exactly the same in response to light reduction of air in train pipe, but when an unusual or heavy reduction of air pressure (10 or 12 lbs.) is made from train pipe, with the old style triple valve, it simply opens a larger passage for air to flow from auxiliary reservoir to brake cylinder; while with the quick-acting triple valves it allows air to flow from *train pipe* to brake cylinder, at same time opening larger passage for air to flow from auxiliary reservoir to brake cylinder in addition thereto.

Where the two equipments are working together, setting new brakes strong enough for air to flow from train pipe to brake cylinder, in reducing pressure in train pipe, so much more adds to sudden and hard application of old style brakes. The new brakes utilizing air from train pipes in setting brakes is cause of sudden reduction of train pipe pressure on air gauge, without a corresponding amount passing through engineer's valve. Except for emergency stops or to avoid accidents, the sudden application of brakes is a wasteful practice, and should be avoided. When properly and economically handled, old style and new style automatic brakes work well together. For emergency stops they are reliable, but for effective and economical work skill is necessary in handling, especially with old style engineer's brake valve.

It is reported that the Government of Chili will build 700 miles of road at once.

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

Photography in the Repair Shop.

The general foreman of a large railroad repair shop in the West has written this office, asking where he can purchase a cheap, easily handled photograph apparatus, and says that it is his belief that in ordering repairs, especially for foreign cars, such a rig would save a great deal of correspondence, and the expense of many drawings.

There is the germ here of a labor-saving, time-saving and mistake-preventing device. We hope to soon see it brought into general use. There is many a tool, or jig, or crane rigged up in one shop on a road that the other shops want; there are no drawings of it, and it would cost more to make drawing than the rig was worth, but if there was a photograph rig handy—and as many "views" of the concern as was wanted would cost but a few cents each and require no time or skill to make them—"kinks" would be more common than they are, and THE LOCOMOTIVE ENGINEER would find it easier to get hold of them.

When odd sized forgings or castings are made, a photo with sizes marked on would be a useful help if it was desired to duplicate them, and save expense of drawings.

The photograph outfit would be a reliable and truthful witness if it could be got to testify at wrecks; it would keep a record of damage done by fire, and keep the boys from lying about the depth of snow on turn-table during "the blizzard."

Fast Time.

There has been a trial of speed between the two principal roads running between London and Edinburgh, resulting in a victory for the London & Northwestern, "West Coast Line," over the Great Northern.

The distance via the West Coast Line is 400 miles, and by the opposition line 392 miles.

The winning engine was a single driver machine of 27 tons weight, and a 7 foot 6 inch wheel; she hauled a tender of 25 tons weight, and four coaches, weighing altogether 80 tons; 24 pounds of coal were burned for every mile run. The train stopped 20 minutes for lunch, and made the run, exclusive of stops, in 7 hours and 25 minutes, beating the noted "Flying Scotchman," of the opposition line, 8 miles in distance, and 7 minutes in time.

There were bursts of speed of over 72 miles per hour, and the average running was 52.6 per hour.

This is announced as the regular summer schedule, and not a fair day exhibition.

In this country we have no trains making any such time regularly. Many runs have been made, for the one time, that were about equal to, and some better than this one, but the public get no benefit of such speed. The best performance we know of in this line was that made on the West Shore road on July 9, 1885, when the run from Buffalo to Jersey City was made in 7 hours and 27 minutes, a distance of 426 miles, and spurts of speed as high as 83 miles per hour were made. This run brings the average running up to 54 miles per hour, so that the English claim of the fastest run in the world falls short. There is an undoubted record of every mile made on the Buffalo & West Shore run.

What will particularly strike the American engineer, is the light weight of the locomotive and cars, and the heavy tender; we are inclined to think the locomotive must have weighed more than 54,000 pounds. English roads run very light cars on their fast trains, while the faster the train in America, the more the average passenger will kick for the luxurious sleeper and parlor car.

The cars hauled by this fast train in England were 20 tons each, 80 tons for the entire train, while in this country the ordinary 52-foot passenger coach (8-wheeled) weighs upward of 52,000 pounds; a 12-wheeled Pullman sleeper weighs 86,300 pounds, while a parlor car weighs 80,600. It will be seen that the weight of three ordinary American coaches would almost equal the English four, while two Pullmans would be heavier than their train.

The Buffalo & West Shore engine was of our well-known 8-wheeled, or American class, weighing 83,000 pounds and having driving wheels only 66 inches in diameter. English engines "get there" in good shape, but give us the same road bed and weight of train, and the "loose-jointed American bogie" will lick them every day in the week, Sunday included.

A Birthday Party.

On the 17th of last month the Brotherhood of Locomotive Engineers celebrated the twenty-fifth anniversary of the birth of the organization, in the city of their nativity—Detroit.

In the morning there was a secret session, at which Grand Chief Arthur explained the present situation on the Q. In the afternoon there was a crowd at White's Opera House, and speeches were made by Acting Mayor John Considine, Governor C. G. Luce, Grand Chief Arthur, Rev. Chas. Reilley, Genl. R. A. Alger, Hon. J. W. McGrath, Col. J. Atkinson, the Brotherhood poet, P. Fennel (Shandy Maguire), and the founder and father of the order, W. D. Robinson.

There were several jolly old plug pullers there who were there at the "bornnin'" twenty-five years ago, and they smiled and looked as happy could be.

In the evening two pleasure steamers were lashed together, and 1,500 engineers, with their wives, mothers, sisters and ownest owns, danced away the hours from 7 till 12 on the Detroit river.

On the 18th the two steamers were again lashed together and the entire party taken up the Detroit, through Lake St. Clair and the river by that name, and landed at Oakland, fifty miles away, where a splendid dinner was served in a pavilion in the park; an ox had been "barbecued," and was now carved.

On the down trip the upper decks were cleared, and dancing was indulged in till the twin steamers touched again at the Detroit wharf.

John McMinn, chief of division No. 1, and his committee, were untiring in their efforts to make everybody happy, and in all the party we heard nothing but praise for the way the whole plan was carried out. There was not a single hitch.

In twenty-five years the Brotherhood has increased from 12 to over 30,000 members, it has raised the grade of temperance and morality of engineers, it has raised wages from $60 per month to from $100 to $150, it has established an insurance that has paid out to widows and orphans alone in 11 years, $2,582,169.61 They have also procured a side saddle for the goat, and there are now many lodges of Lady Engineers, Auxiliaries, they call themselves, and there were lots of them at the party.

It is our sincere hope that the coming quarter century will bring with it as much good and as much improvement as has the past, and that all who celebrated in 1888 may be spared to dance in the head set at the birthday party in 1913, that will surely meet at the portal city of the unsalted seas.

The Pennsylvania's Compound.

It is announced that the Webb compound locomotive, built in England for the Pennsylvania Co., has been completed and will soon be at work on that line. Some of our railroad exchanges have expressed their conviction that it was a shame and a disgrace that this engine was imported instead of being built at home The English roads are the only ones that have made very many experiments with compound locomotives, and they claim great saving in fuel for them, and we are of the opinion that the Penna. Co. did just right in ordering one of the best they had, to try on our hilly roads, and with our fuel, instead of building it themselves.

If a man should attempt to sell you a patent washing machine and made certain claims for it, you would in no way be testing the merits of his machine by having one built as near like it as you could, just because the machine was built in an opposition town.

Let them send their 3-barreled locomotive over here, and send the best engine driver in the Queendom to run it; we will give them a fair show, and if they can prove that the compound is any better than the ordinary high-pressure engine, we will speedily find American mechanics to build and American engineers to run, anything better than we have got. When the compound tackles the Pennsylvania "K" on her own dung-hill, and with her own fuel, she has got no walk-away.

A Heavy Guarantee.

As a rule, when a man claims too much for a device, we are inclined to feel as if it were a frantic effort to sell his contrivance. But when a man offers to do a certain percentage better with his device than you can possibly do without it, or no sale, there is no argument against his proposition but to let him try.

Pedrick & Ayer, of Philadelphia, are the makers of the St. John patent piston packing—the invention of a Maryland mechanic—and they have given it a number of very long and severe tests in different service, and have recently submitted the following proposition to Mr. Alexander Mitchell, M. M. of the Lehigh Valley R'y, at Wilkesbarre, Pa., which, so far as we know, is the strongest guarantee on piston packing outstanding, or any other locomotive device—barring traction increasers and feed-water heaters:

They agree to let the railroad select an engine and give her all the load she can pull up the mountain from Wilkesbarre to Glen Summit with her present packing, then change to St. John packing and add two loads to train, and if she don't make the same time as she did with lighter train, the packing or the experiment to cost the Lehigh Co. nothing.

Pedrick & Ayer are not in the habit of making failures, and if they can back up this offer with results, no railroad could afford to be without the packing, if it had to be made of sterling silver.

One Hundred Pound Rails.

The Belgian state railways commenced experiments some three years ago, in the use of rails weighing 100 pounds per yard, when they laid 300 tons of this heavy steel. Results have been so satisfactory, that last year 10,000 tons were laid, and this will be the standard rail of that country

There has long been a belief in America that there was a happy medium in rail weight, somewhere. The believers in this idea mentioned as one of their arguments that the first strap rail wore out only where they crossed the stone blocks, and that the ends of heavy rails are pounded out of shape as easily as lighter rails; they claim that all heavy rails are, to a more or less degree, anvils, on which the locomotive wheels can beat with disastrous results. There is no doubt that the weight of rails should bear some proportion to the loads they are required to carry. Sixty-pound rails are not heavy enough for locomotives weighing upwards of 100,000 pounds.

We hardly think the 100-pounders would look out of proportion under some of the late build of locomotives with a six-foot boiler.

The Brotherhood of Locomotive Firemen hold their 14th annual—or rather first biennial—convention on September 10th, at Atlanta, Ga. The B L. F. has at its head able men, the rank and file are the flower of the land, physically and mentally, and we always hear something good of their conventions. Without forgetting the other grand officers, who seem to have been born for their places, the order rejoices in and is especially proud of the Grand Secretary and Treasurer, Eugene V. Debs. Mr Debs has had for years the money affairs of the entire order in his hands, and has handled hundreds of thousands of dollars that belonged to the widows and orphans of deceased brothers, and not a single penny has there gone astray; he has been City Treasurer of Terre Haute, and not had to go to Canada; he has represented his district in the legislature, and his voice was always raised in defense of the right and in denunciation of the wrong. Mr. Debs is also the editor of the *Magazine*, the official organ of the order, and his editorials are the ablest and more widely read than those of any labor organ in America The firemen are the first to meet, and will be the first to act in regard to the proposed federation of railroad orders, and, while older orders ought to lead in these matters, we feel confident that the B. L. F. will acquit itself with wisdom, dignity and honor.

N. W. Sample, Supt M. P. & R. S, Denver & Rio Grande R. R., called at this office a few days ago. Mr. Sample is the railroad father of the editor of this paper, and, no doubt, feels much like a hen that has hatched out a duck—dislikes to see it drown because it don't know enough to keep out of the water.

Geo. W. Cushing also called on us; the last time any calls were made we called on Mr. Cushing—to ask for a raise of pay for the firemen on a road under his management We had a clear case of justice, and got the raise.

ASKED & ANSWERED.

(52) Penn., Philadelphia, asks:

How is it that the exhaust injector can be used on locomotives? You said in an article some time since that they would not work where boiler pressure was above 70 pounds *A.*—Where the exhaust injector is used on locomotives there is a supplementary jet of live steam used.

(53) 75° Phillipsburg, Pa, asks:

Where does the 60° or inter-colonial time commence to be used? I see some of the time cards of roads running into New Brunswick and Nova Scotia say "Eastern time." *A.*—Inter-colonial time is not in use. Eastern time is used from the western boundary of Pennsylvania (or above the 82d degree of longitude) to the Atlantic seaboard.

(54) D. E., Troy, N. Y, asks:

What are the principal difficulties in the steam heating problem, aside from the locomotive? As far as the cars are concerned, are there any problems yet unsolved? *A.*—So far as we can see, there is yet to be invented some successful and sure means of getting rid of the water of condensation. Steam heating will not be universally successful until a standard hose coupling is adopted, so that cars of different roads will be interchangeable.

(55) Fireman, Boston, Mass., writes:

Does the term "enginemen" include the firemen? Our superintendent has pasted the following order: The term "enginemen" does not include firemen. Firemen riding on the road without a pass will be expected to have a ticket or pay their fare. *A.*—The fireman is as much of an engineman as the engineer, and if the engineers ride without passes, tickets, or money, the firemen should. We know of no other road where the firemen are not considered enginemen.

(56) Subscriber, Fabyan House, N. H, asks:

Will you explain through your paper what is meant by "mogul engine," what is there different from the rest, and how it derives its name? *A.*—A "mogul" has six wheels connected, and a single or pony truck distinguishing them from a ten-wheeler, having six wheels connected, and a double truck, four wheels. We do not know where the name originated; perhaps some reader with more gray hair can inform us.

IN THE ROUNDHOUSE AND REPAIR SHOP.

If you are pumping oil by main strength and ignorance, read the description of the dumb pumper on another page.

***

Last month we gave the credit of Forney's article on Locomotives and Cars to the *Century*, when it should have been given to *Scribner's Magazine*.

***

There are over 9,000 stuffing boxes on the Pennsylvania Railroad packed with the U. S. metallic packing. Think of this, John Alexander and the rest of you who are picking sticks and braiding hemp every other trip.

***

On the D., L. & W. R'y passenger trains are hauled by hard coal burners, having short front ends and diamond stacks. There is more trouble from dirt and cinders in the cars than on many roads using soft coal and using the extension front and straight stack.

***

Pedrick & Ayer, of Philadelphia, Pa., makers of special tools for railway repair shops, have favored us with a work of art in their new catalogue, illustrating and describing every tool made by the firm. It is a 75 page typographical and mechanical beauty, and with no dance-house fringe on it

***

At the Long Island City shops of the L. I. R'y they have a "balancing pole" on the turn-table, a slim, brightly painted pole on each side, and in the center of table they tell the engineer where he is, no matter how dark or foggy the night. The old way of waiting till she "teeters" is not always safe.

***

In the patent office there quietly slumber several patents for preventing locomotive driving wheels from slipping. Most of them have some kind of a sifter arrangement to carry dust, ashes or cinders from the smoke-box to the rail. Dust is a good thing to slip on; fine charcoal dust will make a locomotive slip about as bad as grease.

***

The management of the estate of F. W. Richardson, Troy, N. Y., are very busy and have been for a year past. They have recently built a large brick addition to the works, that will give them much needed room for machinery on lower floors, and a large, airy drafting room above. They manufacture balanced valves, valve gear models and safety valve springs.

***

The new engines on the Erie have the hand rails extended through the cab. Men who have run locomotives whose boilers come through the cab will appreciate the new grip, if it will keep brakesmen and others from resting their hands on injector throttles, and often shutting off a fine opening the runner has set for a heater—this is awful weather to talk about heaters.

***

The car builder who invented the new style of window that will only raise about eight inches, leaving the lower part of sash directly in line with the eyes, ought to be cremated in one of his own sweat boxes. Companies that have cars varnished with a sprinkling pot, thus gluing the windows fast, should furnish crowbars to enable passengers to raise them.

In stationary practice, corn meal, bran, sawdust, or some similar stuff, is often put in a leaky boiler to close up small leaks, and sometimes does so. Once in a while an engineer will try the bran mash cure on a locomotive, but it seldom does any good; more of it finds its way to the throttle than to the leak. Next to calking the flues, a hot wood fire is the best remedy for leaking flues.

***

We are under obligations to Angus Sinclair, secretary, for a report of the proceedings of the twenty-first annual convention of the American Railway Master Mechanics' Association, held in June. The book contains 221 pages of reading matter with many engravings, and the able way it has been gotten out in such a remarkably short time reflects great credit on the ability of Secretary Sinclair.

***

The military railroad men who served the government during the war are talking of organizing. They think that "the part performed by them was of as much importance as that of those who did the fighting." They ask, "What would the armies have done without railroads and railroad men?" Well, it is the high privilege of the military railroad men to organize, for manifestly they helped to save the Union.—*Locomotive Fireman's Magazine*.

***

The Wooton fire box engines on the Delaware & Hudson Canal Co.'s road have one fire-door opening, three feet or more long, in the center of the box, instead of two doors side and side. This long opening is covered by two doors swinging to each side. There is no doubt this large opening is better than the two doors when it comes to the hard work of cleaning fires—something that has to be done pretty often with fine anthracite coal.

***

J. & J. B Milholland, of Pittsburgh, Pa., have begun the building of light locomotives for the general market, and will hereafter make it an important department of their business. One locomotive built by them eighteen years ago is still in active service. About seventy-five of their wire rope haulage plants for mines are now in successful operation, the latest improvement being, by means of one large sheave, to haul a line of 60 to 80 cars around a right angle, without need of the series of sheaves formerly used, and the consequent need of cutting away the ground for a curve of long radius.

***

The Canadian railways have doubled in length in ten years, being now over 12,300 miles. The number of passengers carried has increased by 66 per cent, and the number per inhabitant by 40 per cent.; the number of tons of freight carried increased by 107 per cent., the number per inhabitant by 97 per cent.; the receipts by freights increased by 87 per cent., and from passengers by 86 per cent, while the total receipts from all sources increased by nearly 90 per cent. and the expenses by nearly 72 per cent. The tons of freight carried last year amounted to 16,368,000, and the number of passengers to 10,686,000.—*Ironmongery*, (Eng.)

The Northwestern Railroader has changed the color of its overcoat from yellow to lavender of delicate paleness—that's right; when you wear clothes, wear stylish ones. THE LOCOMOTIVE ENGINEER prefers to just tackle this weather robed only in a smile. It all depends on how you were brought up.

***

Our correspondent, Jos. Wormald, has been returned to the charge of the N. P. shops at Sprague, Wash. T. He has been m. m. at Missoula, Mont. T., for some time, and in leaving there was presented by the motive power employes with a fine gold watch. This is an improvement on being hung in effigy.

***

We are in receipt of a copy of the fourth edition of Grimshaw's Pump Catechism, a book containing much valuable information for all who have anything to do with steam pumps. It is written entirely for practical men, and we know of no other book in the same field. That it has reached a fourth edition is evidence that it is appreciated.

***

The Cumberland Valley Railroad has a special car for furnishing electric light at picnics and camp meetings, and for removing wrecks after dark. *Engineering News* says: "It is a common box car, strongly built, in which is an 8½ h. p. boiler and engine, which runs a 15 arc lamp dynamo. Each lamp is 2,000 candle-power. There is a globe rack, a reel containing three miles of insulated wire, and all appliances necessary, including a coal box of three tons capacity, and water tank of 1,000 gallons capacity. The car has air-braking apparatus, and has been very useful. In one year it paid for itself in the increased sale of tickets to picnics and camp meetings. The Pennsylvania Railroad also hired it to light up the removal of a bad wreck at Duncannon. Such a car would be useful on almost any railway.

***

During a trip of over a week in which we traveled over more than twenty divisions of eight different roads, we took especial pains to note the way the automatic brake was handled, and found that there was a vast difference in men. On the Central of N. J., and the Reading, the brake was handled particularly rough In all the trip there was but one man, on the Pennsylvania, N. Y., division, who invariably applied the brake with release till stop was made and had air releasing while train came to a stand-still. Most of the others jammed on the brake on approaching a station, released it while everybody held their breath, ran into stations fast and threw brake on full while passengers changed seats and were thrown down by back lurch at final stop. Most of this is want of proper instruction, the rest is habit and carelessness. Many of these men would be benefited by a perusal of the air-brake papers now running in this paper by an expert engineer J. E. Phelan.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. I. NO. X. NEW YORK, OCTOBER, 1888. $1.00 per Year or 10c. a copy.

Packer's Roller Truck for Locomotives.

The object of this device is to aid locomotives in going round sharp curves, and with an easy motion. Where only the ordinary trucks are used, the front end of locomotive has a tendency to be lifted up in passing a curve, thereby throwing a severe strain on frames, and also causing excessive friction on wheels and track.

The device here described consists of a traveling carriage composed of four steel rollers for each truck, together with the necessary shafts and side connecting links. Suspended from the shafts are four hangers, the lower end of each being attached to the springs which carry the center casting of the locomotive or motor. The traveling carriage thus formed runs on side rails of truck frame, the travel being limited by adjustable blocks, as shown in cut. (See Fig. 2.)

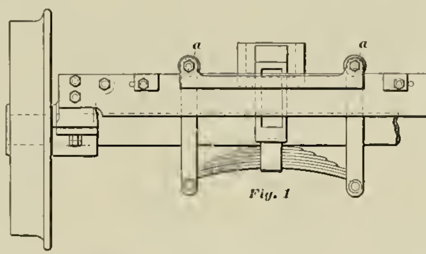


Fig. 1

When a locomotive equipped with this device is passing a curve, the front end of locomotive swings toward outside of track, causing the carriage to travel until the side links strike the blocks or stops, these blocks being adjusted to suit the curves on road where it is to be used.

If, however, in any case, in passing a specially sharp curve, further travel is required than may have been provided for by this adjustment of blocks, this further travel is supplied by the swing of links.

The patentee of this device is A. C. Packer, No. 118 Forty-fifth St., Pittsburgh, Pa., who is a practical locomotive mechanic. Several locomotives equipped with it by H. K. Porter & Co. are successfully running on curves of 35 feet radius.

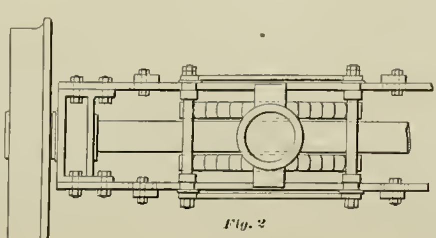


Fig. 2

The Pennsylvania standard sand box is located in the wheel cover and below the running board, being filled through a hole in the latter. It is noted for wet sand and profanity.

Worked Before They Were "Broke In."

The Central R'y of N. J. have erected two large switch towers at Elizabethport, at the junction of the Newark and Long Branch divisions with the main line. One of the towers contains 33 levers, and the other 23, the pair costing over $30,000. On Saturday, the 22d of Sept., the company issued their rules, governing the code of signals to be used, and proposed to put the system into use the following day; to this the engineers objected, saying it was not time enough to become familiar with the signals. The officers then asked all engineers and firemen not on duty, to assemble at Elizabethport on Sunday, and witness a practical trial—they did. One of the split switches failed to answer the lever, and an engine and several loads of coal turned their toes up to the daisies in the ditch.

As it will take one week to repair the damage, the men will have time to study the rules.

The accident is no fault of the system or invention, but the result of haste in putting a complicated device into actual service before it was properly "broke in."

The convention of the Brotherhood of Locomotive Firemen, just adjourned at Atlanta, Ga., declared in favor of the federation of the members of all orders of railway employes, and appointed a committee (with full power to act) to confer with any committees that the other orders may appoint. The committee are: P. F. Sargent, Grand Master; J. J. Hannahan, Vice Grand Master, and E. V. Debs, Grand Secretary and Treasurer. No other order can appoint any abler men.

Editor Wheaton, of the *Conductors' Monthly*, was away last month, and that craft was commanded by the second mate, who very ably poured a couple of volleys into the pirate craft of the Pinkertons. This is one loaf of bread among the many stones in the conductor's pantry.

It would be a blessed thing for the order if Editor Wheaton never came back.

Fatal Changes.

It is now believed by many engineers that the explosion at the Reading depot in Philadelphia was caused principally by a change of injectors and the method of placing them. The man had never handled the engine before—she was new. He had been used to a Sellers injector—the new engine had a Monitor outside the cab, with the overflow pipe turned into the ash pan. The engineers think that he started the injector and throttled it down to work fine, then getting the sound of steam in top gauge cock for water, and knowing that the injector was on, he felt safe, if the steam pressure goes down considerable an injector will often break by shooting the water out of overflow very fast, showing no steam, and if the drain pipe would carry it to the ash pan it could easily fool a man. Where injectors are located outside of cab, we believe the overflow pipe should discharge where engineer can see it; if it is inside and the overflow open, then the drip can safely go into the ash pan. Many a good man has been lured to disaster and death by changed conditions far slighter than the engineer on this engine had to deal with.

An Exhaustive Test.

"Engine 146 on the Erie experimented with Luttgens patent stack on Wednesday. The engine was attached to the milk train, and lost 23 minutes' time in the run from Jersey City to Paterson, proving a failure. —*Bergen County Democrat.*

Mr. Luttgen sends us the above item, and says it is not true in any particular. We are glad to know this, not so much on account of the inventor, as for the record for horse sense of engineers. The Luttgens damper consists of a series of openings at the base of the stack, and they are opened or closed by the engineer from his seat in the cab. If any man lost 23 minutes on account of the damper opening, when he could close it by the exercise of one grain of sense and two ounces of muscle, he must be a dandy.

Air Brake Practice.

BY J. F. PHELAN.

SIXTH PAPER.

The same general rules should apply in air brake service on both ordinary track and mountain grades, modified on mountain grades by use of the retaining valve that holds 10 lbs. pressure, more or less, in brake cylinder, and prevents that amount from escaping into atmosphere when brakes are released. This retaining valve is connected by small pipe to exhaust port of triple valve. The location of this retaining valve is under car, attached to cross-beam, or at end of car, near roof, within easy reach of train men. When retaining valves are part of brake apparatus, air always exhausts through them when brakes are released. When not in use they give free passage for air to release and empty brake cylinder. When descending mountain grades these valves are turned on by train men, and instead of leaving a free passage for all air to exhaust from cylinder when brakes are released, about 10 lbs. of amount that has been in use is retained within brake cylinder, and usually acts in keeping brake shoes well up against wheels, and greatly lessens amount of air required for applying brakes when needed. This amount of air held on brake cylinders descending mountain grades causes brakes to act promptly in response to light reductions of pressure; amount required depending on rate of speed and kind of grade descending.

Engineers who are most successful in air brake practice on mountain grades are those who study the grade and know where a "let up" commences and the steep places begin. A study of the grade is the secret of success in mountain practice.

Double-heading is a rule in mountain service, and it is always desirable to have either of the two engines in condition to use the brakes at any time while in service.

In directing such service the following rules were produced and enforced by G. W. Cushing, when Supt. M. P. & M. on Northern Pacific R. R., and are now in force on same road.

"When two air brake engines are coupled to a train the *forward engine must control the air brake*, but both engines should be coupled up to air pipes, and may be used to pump air into train auxiliary reservoirs, in case it is desired to do so, *when train is not in motion.*

"When train is in motion the rear engine must 'blank the air' by turning the valve to the right, nearly to the point of application, and let the leading engineer do all the braking.

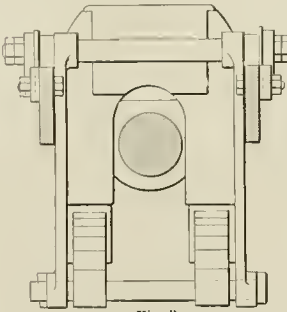


Fig. 3

"Otherwise the brakes may all be pumped off by the rear engineer, very soon after the brakes are applied by the first engineer, and this will render the brakes useless. Hence the leading engine must control the train brakes entirely and absolutely, except in case of accident to air of leading engine, and until a proper signal is given by the first engineer for the second engineer to assume control of the air brakes on train, for which contingency the second engineer must at every moment be prepared to act instantly on a mountain grade."

This "double-header" rule is not only enforced on mountain grades, but all engines have air pipe run through to pilot, where air hose is attached ready for use at any time, and in freight or passenger service, when double-headers are run, the leading engine controls the brakes.

Something to show the advantage to the country of railways can be seen in the rates of coal haulage in Pennsylvania. Anthracite coal is hauled from the Wyoming region to Philadelphia, 229 miles, for $1.90 per ton, which is but 8.2 mills per ton per mile. What it would cost to get a ton of coal from the Wyoming mines to Philadelphia by mule team can be imagined.

Safe Train Orders.

A Canadian correspondent of the *Locomotive Fireman's Magazine* says that the Grand Trunk road use a very plain system of train orders. He gives a specimen:

"A special train would get an order like this: 'All due in. Run to A, avoiding regulars.' If any regular train was late the special would get a straight meeting order: 'Meet No. 1 (one) at B.' Or else a time order: 'You can have till 9:15 (nine fifteen) to make B. for No. 1 (one).' No. 1 would get an order: 'No. 126 has till 9:15 to make B for you,' and No. 1 must not pass B. if the special is not there until 9:20, allowing five minutes for variation of watches. Nothing could be clearer than this—very unlike the complicated orders sometimes given on many roads."

The "all due in" is a good idea; on many of our roads it is customary for conductors and engineers to have to "check up the register," losing time to do so, very often, and we have heard more than one embryo dispatcher make the "crack," "if it hadn't a been for me, so-and-so would have pulled out against No. 49." And perhaps 49 was overdue ten hours. The idea seemed to be to see if the crew were "slick" enough to *ask* for orders, instead of having them ready.

With all the complication of orders, the duplexes and compounds, and their ilk, there may be more security for the dispatcher, but when a man is allowed to change time card meeting points at all, he should be competent to give single, direct orders. Any engineer or conductor would rather get an order to meet No. 1 at Smithville, than to get a closely written order telling them what half the trains on the road would do, where only one line concerned them. The complications tend to confuse men—the orders are often read on running engines and in the dead of night. It is no concern of the through express where O'Brien's work train will side-track and let Jordan's extra stock train by—both have got to keep off the time of the express. It is also no concern of O'Brien or Jordan where No. 1 and No. 2 are going to meet—they have no authority to use time on them.

Simplicity in train orders is the price of safety.

Murderous Designs.

We ran across a fireman the other day who was carrying his hand in a sling. Had to support himself while on running board by a hand rail that also served the purpose of a blower pipe—cooking meat half off the palm. Such devices as these have killed more than one man, and the parties who keep in use such designs should be held just as responsible for the murders as if they had killed the men with an axe.

The Frog (Salida, Col.), a semi-monthly, "devoted to the railway interests of the West," is out with No. 1, Vol. 1. Our old friend Cy. Warman, a stove-up engineer, is editor. We hope *The Frog* will hop into popularity and never croak.

Historical Locomotives.

THIRD SKETCH.

We have been favored with a photo. of engine 210, D & H. C. Co., the engine that drew General Grant's funeral train from Saratoga to Albany, on Aug. 4, 1885. The engine is a modern 8-wheeler, made by the Dickson Locomotive Works, Scranton, Pa.; she weighs 45 tons, has driving wheels 66 inches in diameter and cylinders 19x24.

The picture shows her as she appeared draped for the trip. There were used 350 yards of black cashmere on the engine, and 2,700 on the cars.

We hardly think the occasion calls for an expensive engraving, as there is nothing odd, or liable to soon pass away, to be shown. The draping was excellently done, and looks well in the picture.

On the funeral trip the whistle was not blown nor the bell rung, the run was made on a special time card printed with a mourning border, and the engine carried black flags—the only instance of the kind we have heard of.

Willis G Fisher was the engineer, and he runs the same engine yet on a regular passenger run between Troy and Whitehall.

Crowds of people lined the road on that day to get a sight of the train, and probably no locomotive has drawn the remains of mortal man more widely or sincerely mourned since Abraham Lincoln's cortege from the White House to the tomb at Springfield.

Peculiar Narrow Gauge Engines.

The Baldwin Locomotive Works are building a number of heavy consolidation locomotives for a narrow gauge road in Mexico, that have their drivers inside the frame; there are heavy wrought-iron cranks on the axles outside the boxes. This arrangement makes it very easy to get at, oil, clean or repair the boxes, frames, etc., and, as the frame is much wider, it admits of a wide, short fire-box, with all the drivers ahead of it. The engines in question have very large boilers. We do not see why this plan would not be an excellent one for roads to follow that expect to change to standard gauge; the right proportions could be followed, and then the change made by simply removing the cranks and shoving the drivers out into their places.

While outside frames are commonly built in European shops, locomotives are rarely made that way in this country.

A Pitless Turntable.

The Greenleaf Turntable Co., of Indianapolis, Ind., have put on the market a table of 100 tons capacity, that requires no pit. There are no end bearings or circular track. The table is supported on 16 conical rollers, and held steady against a large central pivot by 27 other rollers set vertical.

Some More Air Pump Tools.

BY H. R. JONES.

Every machinist or engineer knows the value of a "set," or "persuader"—as I call it—to loosen a stubborn nut in a bad

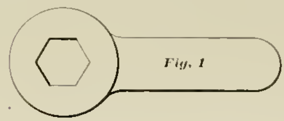
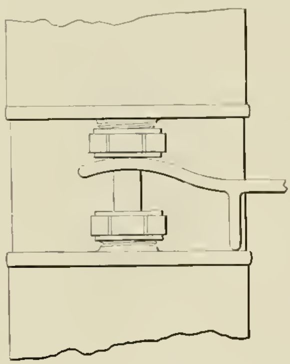


Fig. 1

place. It is a mighty handy tool sometimes, but is used a great deal more than it ought to be, especially on finished nuts and brass work in cabs. I have seen injector throttles and cocks ruined by its use, but that it will start a rusty nut when a wrench will not is true, nevertheless; you have doubtless seen the hexagon



sides of the caps to reversing valves and pistons to air pumps all cut up by their use, but the wrench furnished by the Westinghouse Co. for that purpose is entirely too short and light to take off one of these caps when they have become corroded.

Now I have used what might be called a cross between a persuader and a wrench for this purpose. It has the advantage

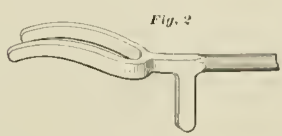


Fig. 2

of being short, light, and easily stowed away in the tool box. It will start any nut or reversing valve cap that will start

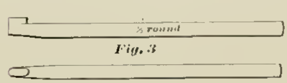


Fig. 3

with a wrench two feet long, and more than that, it will not mar the corners any more than will a box wrench. It is nothing more or less than a short, strong, box wrench like Fig. 1, used with a hammer Make one and try it and you will never be without one either in the shop or on the road. The handle should not be over six inches long.

To screw on the packing nut to the steam piston when it is hot and burns a fellow's fingers is something that makes him hot, and say bad words sometimes. Fig. 2 shows a pair of iron fingers that will effectually hold the nut up with any desired pressure till you get the thread caught, and will not make a fuss about being burned, either. By turning it upside down it will work equally well for the lower nut. Hold it in one hand and the spanner wrench in the other.

For pressing rings of packing into the stuffing box, I have found a tool like Fig. 3, to be very handy By using it on both sides of the rod you can get all around it, and by prying down over the edge of the packing nut as a fulcrum, the short finger will force the packing up into its place nicely, so that the gland nut may be easily screwed on.

There has been considerable said about mysterious pounds in air pumps I have had some trouble in that direction myself I had a pump once that bothered a good while before I found the trouble

The air piston head had worn quite loose in the cylinder, and as it reversed at the down stroke it would make a pound that would jar the whole engine. I reasoned like this, that in reversing the motion the piston head was suddenly and violently thrown against the side of the cylinder. A re-bored cylinder and new piston head cured that pound, but as the causes for pounds in air pumps are so numerous and varied, this remedy may reach only a few of the many cases. It was not a heavy thud, as when the main piston strikes the bottom head, but was of a rebounding nature, as if you should strike a bell with its clapper, and try to hold it for an instant on the vibrating metal.

In Early Days.

In the office of Pedrick & Ayer, Philadelphia, we found several old bound volumes of the *London Mechanics' Register* of 1827 28, and in them much of the experience of the earliest railroading. In an editorial, in which the editor takes other journals to task for condemning the use of steam locomotives so early in their career, and in which he claims they will pull more than horses, he says:

"We repeat that we do not wish to be whirled along at the rate of twenty miles per hour, but if we can go at the rate of ten, without danger of having our neck broken—or the insolence of coachmen, or the annoyance of dust or mud, and what is more than all, the distress of the noblest of the brute creation, the horse, we shall bless the labors of steam carriage projectors"

This was written but 61 years ago, but it was before the Rocket, or the Puffing Billy, or the John Bull, before the Stourbridge Lion was built or a mile of track laid in America. We hope the writer lived to be "whirled along" at his coveted ten miles per hour, and fifty besides.

Magnetism in Watches.

It is now a recognized and acknowledged fact that magnetism plays an important part in the destruction of watches and in making them run unevenly.

We all know that an ordinary watch can be ruined by bringing it in contact with a powerful dynamo; if this is true a less powerful magnetic current is well able to do damage in proportion to its force.

There are few intelligent railroad men who do not know that locomotives and cars produce currents of electricity, and that ordinary watches run faster or slower when the person carrying them is on or off duty.

Railroad men are so used to changing their watches to the standard clock, that they do not observe these deviations from the straight and narrow path—let alone following out the causes. Means of overcoming these difficulties have been sought by able watchmakers and electricians, but without success until the very recent inventions of C. K. Giles, of Chicago, Ill., and C. A. Paillard, of Geneva, Switzerland.

Experience has shown that main springs of watches break more easily and oftener when the watch is unprotected and subject to any magnetic influence, and that the balance and hair spring vary in their movements more or less, as the influence increases or diminishes.

Shortening or lengthening the hair spring is the means provided to delicately regulate the watch; now, when this slender spring becomes magnetized—the same as a knife blade is—the sides of the close coil stick together, and make any attempt to adjust the spring to proper length of no avail.

A very ordinary amount of electricity can easily magnetize this spring, and until it is removed the watch is in no degree reliable.

Mr. Giles encloses the entire works in a soft iron shield, that prevents any magnetic influence from reaching the works of the timepiece. The device is simple and is easily applied to watches now in use, and is already meeting with a great demand.

Mons. Paillard's invention accomplishes the same object by making the balance and spring of a non-magnetic material.

The balance and springs of the Paillard watch are composed of from sixty to seventy-five parts of palladium, fifteen to twenty parts of copper, and from one to five parts of iron.

This makes a metal that is non-magnetic and unoxidizable, and having the required elasticity, hardness and ductility for this important work. Watches provided with this invention have run accurately for months in actual contact with dynamos. The invention has made a great name for the inventor, as the alloy is of use in other arts than watchmaking. We would advise all railroad men, in purchasing timepieces, to see that they are in some way protected against magnetic influence, as it costs nothing extra; men who are inclined to think there is no magnetic influence at work on their engines now, and who only call electricity by that name when the current is strong enough to kill, are reminded that the engines and trains are liable to be lighted very soon by electricity, and there may be a dynamo on the foot-board to balance the air pump.

To Clean Strainer While Running.

H. D. Medrick, an engineer of Port Jervis, N. Y., has invented a foot cock, or lazy cock, for pump and injector feed pipes. It is placed where they ordinarily are, next the hose coupling; the taper plug is larger than ordinarily made, and contains the strainer; one side of the casing has an opening to the atmosphere. By turning the cab handle to one position the strainer is on and the feed can be varied; at another the side of strainer next to tank is open to the outside hole, and cinders and other obstructions can be washed out. It can also be used as a frost

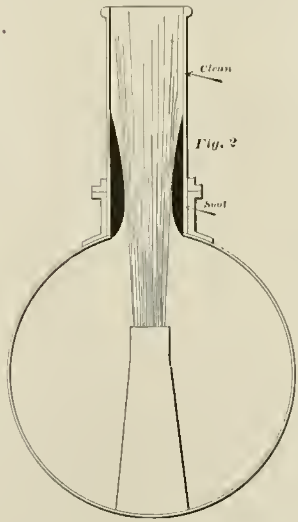


Fig. 2

plug to prevent freezing, and has an advantage in the fact that any of these results may be accomplished without stopping the engine or the engineer leaving his seat.

From Old Mexico.

Lewis S. L. Champlin, an engineer on the Mexican National R'y, called upon THE LOCOMOTIVE ENGINEER a few days since and gave us some pointers about railroading in the Republic of Cactus and Dobie dollars. Native firemen are employed almost exclusively, and natives are running most of the switch engines, and, on some roads, those on short branches; as yet Americans are employed on all main-line engines, and good pay—Mexican money—is paid them; all native engineers are working for very small pay, usually for $50 to $60 per month.

The climate is not so bad, but board and lodgings are inferior in most sections.

The American engineers have a very prosperous division of the Brotherhood located at the City of Mexico—Americano Div. No. 224. Bro. Champlin is a Connecticut boy, and has come clear up here to get "the girl he left behind him;" he proposes to do the rest of his locomotive running in a land where there is no discount on silver dollars, and where an engineer does not go to prison for killing a drunken man who goes to sleep on the track.

Bro. Champlin also ran an engine for several years in Peru, S. A., but the little tiff between that country and Chili, a few years ago, sent all the engineers from the U. S. back where they could see the stars and stripes.

For Japan.

John J. English, who recently returned from South America, where he represented the Baldwin Locomotive Works, has again shaken the dust of America from his feet, with a ticket in his pocket for Japan. Mr. English stops in Nevada, California, Oregon and British Columbia on his way. The Baldwin Works already have four locomotives at work in the Mikado's empire, and they are giving such satisfaction that specifications and guarantees for a heavier class of locomotives are now desired for the imperial highways of the realm.

The railroads of Japan, like those of Australia, are being built more like the roads in the United States than those in Europe, and in consequence the American locomotive is better adapted to their needs.

Pitless Shops.

The P. & R. shops at Reading, Pa., have no pits sunk into the floor, but have a clean floor throughout the shop. In lieu of pits they have movable tracks on iron pedestals that set up from floor. When engines are out the tracks can be removed and a clean floor left. In case but few engines are in shops, no unsightly and dangerous pits are left open, and in case the shops are crowded the pits can be arranged closer together. There are many advantages about this system that will present themselves on a little thought. On standard gauge engines having large wheels, no very extensive pit is necessary, but in narrow gauge shops, where pits need to be from three to four feet in depth, putting heavy engines up on high and narrow legs would be dangerous.

On September 9, an excursion train stopped on a curve near Pittman, O., on account of a broken connecting rod, and a flag was sent back—but not far enough. A freight train ran into the passenger, killing the engineer and several passengers, and injuring 25 more. The poorest kind of a power brake would have stopped the train. Thirty freight cars running at thirty miles per hour on a down grade, and depending on hand brakes, is a fearful thing to turn loose on a single track road.

Some Smoke Stack Experiments.

BY FRANK C. SMITH.

You are making your paper a very interesting one, and I prefer it to others in the same line. Now that you have demonstrated the want of such a paper it seems odd that a similar one was never before published. It fills a niche never before occupied. I am quite confident, however, that you are wrong in your estimation of a good heater. I have eight of my own design. (Fig. 1.)

This lies under belly of boiler, and is 15 inches diameter and 8 feet long. The water goes through the flues—the steam around them. If the drip cock be left *wide* open the engine will not steam, as the exhaust escapes too freely and no pull on fire results. But as it is only necessary to provide an escape for the condensation, which is very little, no difference in pull on the fire can be detected, whether the heater is in use or not. I use a pump with the heater, because the colder the water is introduced to the heater, the greater the absorption of heat units and the greater the economy. I find we put the water into the boiler at from 180 to 200 degrees. Now take an engine taking five tanks of water in, say, 130 miles—the tank holding 3,000 gallons, and the normal temperature being 60 degrees. The economy is the amount of coal required to heat 15,000 gallons of water from 60° to 180°. You will readily see that a very considerable quantity of steam may be taken from the nozzles without detriment, if the stack is of right size and shape.

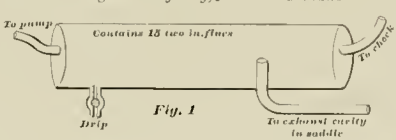


Fig. 1

The "rule" is to use a stack the size of the cylinder. Now I find a 17" stack on a 17" engine is wrong, because when I let a light down into the stack I find only a short distance of the top of the stack to be clean, the stack having a coating of soot as in Fig. 2, page 4, because the exhaust does not touch it. The outline of the soot in fact gives the proper shape and size of stack. Well, I make such a stack and find engine steams much more freely. This shows that by using the right stack I can get the same effect on the fire with larger nozzle or retaining same nozzle with less steam, using the surplus in a heater with the better economy. Now I was not satisfied with mere theory on the stack question. I therefore drilled holes 6" apart on a straight, 17" stack, as at (*a*, *a*, *a*, *a*,) in Fig. 3, and find smoke escapes *forcibly* only at the top holes. Then I change the diameter for a less diameter, until smoke escapes equally at *all* the holes, showing the stack to be filled completely its whole length.

I make another test with a vacuum gauge, as shown in Fig 4. The bend of the pipe and glass are filled with red ink up to dotted line. The pulsations of the exhaust are clearly shown when engine is working slow, by the rise of the ink in the glass. I find with the *smaller* stack that the ink rises in unison with the exhaust, as if tied to it with a string, and stays raised *much longer* comparatively than with the *larger stack*, showing a greater and longer pull on the fire. But against this, Johann, Lauder and other big M. M.'s., are on record to the effect that there is nothing in the smaller stack. Their statements will carry weight and they believe they are right. The difference is simply that any device, unless adapted in all its details, may not be a success.

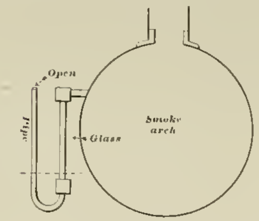


Fig. 4.

The height of the nozzle, the size, shape and length of stack, must be right. Lauder may have tried smaller stacks, but evidently not the *right sized* stack. *Facts* are *facts*, regardless of the findings of Lauder or Johann, or anybody else. As to results, I find the heater makes 1½ tons of coal difference in a run of 130 miles. In other words, with the heater the engine uses 5 to 5½ tons in a round trip—260 miles. When heater is shut off the consumption is 8 to 8½ tons.

Delaware, O.

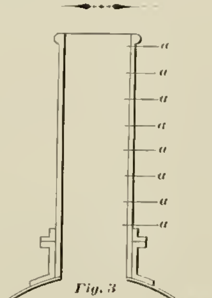


Fig. 3

Hard Tests of Chilled Wheels.

Probably no recent invention in railroad equipment has been of so much importance, or contributed so much to the life and safety of rolling stock as the Whitney contracting chill for cast-iron wheels. The chill on tread of cast wheels is produced by casting the tread against an iron ring instead of in the sand; this ring suddenly cools the iron, making it very hard, but owing to the fact that the ring of iron soon heats and expands away from the wheel, has made the chill very uneven in depth, as well as affecting the shape of the wheel. The Whitney chill is made of cast-iron with a solid outer ring with spoke-like projections to the inner ring that comes in contact with the tread of wheel; between each of these spokes is a cut entirely separating each spoke and its segment. These cuts are made by inserting pieces of asbestos paper in the mould, so that in a 26-inch wheel there are about 100 sections with openings between of about one-hundredth of an inch; this ring or segments of ring heat first, and must expand, but, as they are held in by the cold ring behind, they must go in, and in doing so compress the metal of the wheel and deepen the chill.

Last week at the Whitney Wheel Works, Philadelphia, the inspector of the Reading road made some tests of wheels for that company, using the Penna. R'y test, and the test of strength was as follows:

Average number of blows to start the first crack = 15 for 26" wheels, 53 for 30".

Average *additional* blows to break wheel in two = 50 for 26" wheels, and 30 for 30."

The least depth of chill in these wheels at the throat of the flange was $\frac{7}{16}$".

The greatest depth of chill in these wheels at the throat of the flange was ⅝".

As regards uniformity of size, or circumference:

In 133 out of 150 26" wheels, and 253 out of 350 30", there was no variation.

In 148 out of 150 26" wheels, and 349 out of 350 30", the extreme variation was only ⅛ of an inch.

This is remarkable accuracy for cast-iron work.

These works make about 200 wheels per day, all made in this chill; there are nearly 600 contracting chills in use in the works.

The Lodge Room Book-Case.

Don't have cheerless lodge rooms. Brussels carpets and pictures don't always make them enjoyable. Have a book-case with something in it; if nothing more, the bound catalogues of the different locomotive works, power brake, injector and lubricator companies, will be of intense interest and convey valuable information. Vote surplus money for books, papers, valve gear models, etc. Division headquarters and lodge rooms ought to be schools of locomotive engineering on the co-operative plan. For a few hours once a week talk over what you have seen and heard during the week at your work. Thought and discussion can have but one result, and that is the good of all who take part, from the oldest bald head that sits upon the right hand, to the youngest cub who stands pigeon-toed before the M. M for having got left.

The new passenger engines on the Reading road have been lightened up 11,000 pounds, by having their wagon-top boilers replaced by straight ones with radial stays. Their original boilers will be used on consolidation engines for the same line. It is claimed that the engines were found a little too heavy to run cool.

Fibrous Packing vs. Metallic Packing.

Prior to the invention of the double-acting engine by James Watt in 1782, all engines being single-acting, that is, taking the steam upon one side of the piston only, no stuffing-box or rod packing was required; but Watt and 90 per cent. of the steam engine builders, from his day to this, have used fibrous packing, and many enginemen of the present time suppose that metallic packings are modern improvements, but in reality, a patent on metallic packing was taken out as early as 1797 by Edward Cartwright. With these two as starters, there has since been patented enough devices on the same general principles to make, when the specifications are bound into books, eight volumes of about two inches in thickness, with a total of about 5,000 patents. But despite all the research and money represented by these many devices, no metallic packing was fully successful until 1876, and even at that date the success was limited to certain types and classes of engines.

Commencing in 1876, and making their first public exhibit at the "Centennial" exhibition, the United States Metallic Packing Co., Philadelphia, Pa., have probably done more to develop and make metallic packings successful than all other parties combined; and they are now the owners of 36 patents for metallic packings, and devices connected therewith, covering improvements which are essential, and upon which they have established a large and rapidly increasing business. They have made a special study of the requirements of marine, stationary, locomotive, and various other types of engines, refrigerating machines, etc., and while taking advantage of the good devices found in some of the earlier patents and inventions, they have learned how to avoid the errors which have caused so many failures of eminent mechanics in the past. The company did not jump into success and wealth, being extremely cautious not to undertake any important work until they had studied its requirements and fully tested the several devices to be used.

Their piston-rod packings were a success beyond question, three or four years before they were satisfied, in its application to valve stems and other rods of varying stroke, on account of the greater wear of the stem within the line of cut-off or shortest travel, and this was especially the case on packings applied to locomotive valve stems. But all of the difficulties have been overcome by the invention of the several devices which the company have since protected by letters patent in the United States, England, France, Belgium, Germany, etc.

Their packings for locomotives consist of three babbitt rings placed in a cone, the cone resting against a socket ring, which forms a ball-and-socket joint, the whole being kept in place by a follower and spring, the latter pressing the socket ring against the head of the case, and forming there a steam-tight joint, while at the same time it holds the babbitt rings within the conical cavity, and prevents their being displaced by the movement of the rod or stem, when the locomotive is running down grade or at any other time when the steam is shut off. It is essentially a steam packing, as the steam forces the babbitt rings into the conical cavity, and thus causes the rings to close steam tight around the rod, the babbitt being the only metal that touches the rod. The rod may vibrate up and down a quarter of an inch, and at the same time it may be up at one end and down at the other, and yet the rod is not touched by any hard metal, and consequently cannot be cut and grooved. This result is due to the use of the ball-and-socket ring, which is the "key of success" of metallic packings, the patent for which is the property of this company, and all packings manufactured by them, for any class or type of engine, have this essential device.

As evidence of the value of their locomotive packings, any one traveling on the Pennsylvania Railroad from New York to Chicago, or any of their branches or leased lines, can see the perfect working of these packings on most of their engines, as on these roads alone they have upwards of 9,000 packings in use. More than 200 other roads in this and foreign countries having these packings in use, bear further evidence of their merit and established success.

The Canadian Pacific, the Northern railway of this continent, is quite fully equipped. The Jacksonville, Tampa & Keywest, in Southern Florida, the Intercolonial in the East, and several lines to the Pacific coast in the far West, as well as the far-off countries of Australia and Brazil, send frequent orders for these packings.

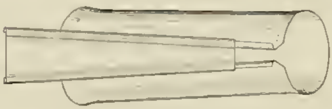
Mr. J. S. Cook, Master Mechanic of the Georgia Railroad, reported at the meeting of the Master Mechanics' Association in St. Paul, Minn., that one of his locomotives had run 160,000 miles without repairs to the packing, but the Metallic Packing Co. do not claim that they will make but about 75,000 miles on an average without renewal of the babbitt rings, which is the only part subject to wear.

That the success of this company is not confined to railways, is evident from the fact that the new steamship "City of New York," recently built for the Inman line, is fully equipped, and has 20 of these packings on her main engines alone.

Emergency Hose Clamp.

Every railroad man employed where there are air brakes has been annoyed or delayed by a slight rupture in the rubber hose; a very small leak is enough to "bleed" the life out of straight air brakes, and the same rupture will set the automatic, making it an element of danger. The leaks are caused in various ways; poor hose, jerks by not uncoupling hose, but principally by chafing against brake beams or other parts of the car or engine. The hose between the locomotive and tender are especially liable to rupture; the air is hot this close to pump—it rots the hose; the oil used in the air cylinder reaches these connections; in fact, they are a trap for most of the oil; this rots and weakens hose also. How many of you have had to stop on the road and replace a ruptured hose, or, in the absence of the "extra," have wrapped the broken one with a piece of sheet rubber and a cord? We have been there.

W. F. Relyea, our correspondent who has charge of the air brakes on the N. Y. C. road, at Syracuse, has devised a neat, cheap, easily applied and effective patch for all such trouble. As will be seen by the engraving, it is a band of sheet-metal generally Russia iron, with both edges turned over to form a groove or flange. The piece is wider at one end than the other, but is turned up straight, so that the opening is slightly tapered, a key piece suitably flanged and of the same taper fits over the opening, and by forcing this key piece up the clamp is tightened.



HOSE CLAMP.

By releasing the pressure and then applying this clamp as tightly as possible, with the fingers, the pressure can be returned to the hose, and will of itself force out the edges of the hole and make a joint. One of these clamps placed over a hole over an inch in diameter has stood a pressure of seventy pounds without a simmer. By using a piece of rubber under it, iron pipes can be temporarily repaired in the same way. They are as effective on water hose as they are on air.

One or two of these clamps would be a good thing to have in every seat box, and in every caboose and baggage car. The clamp is much neater to apply to hose for a chafing iron than the cumbersome clamps held together by bolts, we so often see.

Correspondence

Home-Made Dope for Brass.

Editor The Locomotive Engineer:

I see there are many brother firemen inquiring how to clean cab brasses. I use sperm candles, so called, rubbing them on the brass while it is hot, and allowing it to remain an hour or two, then wipe off and polish.

My brother, who is engineer of a steam fire engine, cleans cold brass with equal parts of salt and vinegar, but I could never make it work on a locomotive.

I make a dope as follows: one ounce camphor gum, two ounces alcohol, two ounces spirits ammonia, four ounces spirits of turpentine, one pound of sperm (star or miner's candles will do), one pound clean tallow and one pound of tripoli. I first dissolve the camphor in the alcohol, then melt the tallow and sperm and stir in the liquids and tripoli, and let the whole cool. Keep in a tin pail with good cover. This will give you a big dose of good dope in the shape of a stiff paste—it should be about as stiff as shoe blacking. To make harder use less tallow or more sperm; to make softer use more tallow.

Omaha, Neb. JAMES ARCHIBALD.

Been There Before.

Editor The Locomotive Engineer:

In the ENGINEER for April you have cut and description of a planer bar, patented by C. F. Geyer, Aurora, Ill. My object in writing you is that honor may be given where it is due. I have known of this device for the past six years. I believe it to be the invention of J. J. Daglish, late M. M. K. & G. S. R'y, Tyler, Tex. I took charge of the St. L., A. & T., at Tyler, in 1885, and found the tool there; it had been in use several years. Mr. Daglish is now in the hardware business at Tyler; would like to hear from him about this *new tool.*

Yours respectfully,

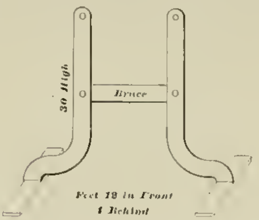
Dennison, Texas. E. S. MARSHALL.

An Unusual Air Pump Failure.—Rebuilding Pumps.

Editor The Locomotive Engineer:

As there is no answer in last month's paper to my question in August issue, I will tell what I found in the pump. There is a small hole drilled and tapped in top of reversing piston for the purpose of receiving a threaded rod to draw out the piston; the hole in the reversing piston of this pump was drilled so deep that the point of the drill just went through, leaving a $\frac{1}{16}$" hole, that being enough to allow steam to pass through to the under side of reversing piston, thereby relieving pressure on top of it and allowing main steam valve to raise, which caused the pump to act as I stated.

Believing that there is always something to be learned by an exchange of ideas and methods of doing work, I thought perhaps I might draw out something new from some source by giving my way of repairing air pumps. The first thing I do is to take the "donkey" all apart, put it in potash and let it soak for three or four days; then I take the parts out, turn the hose on them and wash them off clean, and the castings are like new ones. To erect the pump I bolt the air cylinder on a frame made of 2" x $\frac{5}{8}$" iron, with feet on the bottom to prevent tipping over (see drawing). I then ream air valve seats and fit valves to them, then put on the center piece, using copper gaskets for joints; next I tackle the steam cylinder; I drive out the lower main steam valve bush and draw out the upper one. After putting in new bushings, I put on the cylinder, put in the piston and main steam valve, and, before putting on the cylinder head, test the main piston and steam valve to see if they blow; in order to do this I fasten down the main steam valve, stop up the port that leads to the reversing valve, then pack upper stuffing box and put a piece of pipe about nine inches long on the lower end of piston-rod, with piston-rod nut and washer. Now for the test; I do this by connecting air hose on steam pipe connection of cylinder, and from there to the tender of an engine in the engine house, which is next to my shop. I start the pump on the engine and get anywhere from 80 to 100 pounds' air pressure, open stop cock on the tender and send the air to the pump in the shop, having a stop cock next to the cylinder of pump I am working on. I can use the pressure as I want it. I now put on pressure enough to raise the piston as far as



the pipe on the lower end will allow it to go, then I give it the full pressure, and if there is any blow I can find it. I leave hose connected until I get the pump all built up and ready to work, and use the same pressure to work the pump, and find leaky joints.

This is about the way I do it. Who is "next"? W. F. RELYEA.

Syracuse, N. Y.

The "Standard" 24-Hour Dial.

Editor The Locomotive Engineer

I noticed your article on the "twenty-four o'clock" system in your issue of July. As that is a subject I am interested in, I have taken the liberty to send you this communication. I surely agree with you that the double-system dial is crude, and think the fewer that get in use the better. I also think Mr Colvin's idea of putting the 1 and 24 at the bottom of the dial is correct. This idea struck me some time ago, but I never thought it had been put in practice until I read your article. I think one of the greatest drawbacks with

twenty-four hour watches is that the modern dials that have been used are confusing to most people. I send you with this letter a dial that I think you will say is both simple and artistic. I have received a patent for it.

You will see that much is gained by putting the twenty-four figures on the outside of the minute scale, as it gives the largest possible circle for them, allowing them to be made larger and put further apart than on the old arrangement. The little red figures that mark the minutes in multiples of five, serve their purpose much better on the inside of the scale, as they can be more readily seen. The little points that project from the inside of the scale help one to quickly determine whether the hour hand is pointing directly at the center of a figure or at either side, especially the *odd* numbers. One thing that helps the appearance of this dial is that the second circle does not cut out any of the hour figures, where, on the old arrangement, it cuts out the 12, and almost all of 11 and 13. I have not had any of these dials made with the 1 and 24 at the bottom, as I thought it would not be a good idea to make too much of a change at one time, so I followed the old custom of completing the hour when the minute hand reached the top. I call this dial the "Standard."

JACK SINGLETON,

St. Louis, Mo. Pullman Conductor.

A Dinner Pail Sermon.

Editor The Locomotive Engineer

Ever since railroads got to be over 40 miles long, or locomotives were in use, the men who have had to fire them and run them have been breeding dyspepsia, gout, and the holy horrors, by eating sundry cooked and uncooked decoctions from the mysterious and uncertain depths of 900 different kinds of dinner pails. What the victim eats—on a night run, 30 miles from a habitation and with the appetite of an ostrich playing hide-and seek from his spinal column to the front button on his pants—depends upon what kind of a woman he has married, or how he stands at the hash foundry. If he has an indifferent foundry he can change, but if he has an indifferent wife the victim can only wait patiently for the glad summons that calls him from hence unto that fabled Utopia where petrified biscuits do not break through and steal, or sour bread crawl into his stomach and chew the lining off.

Let us hope that he is happily married to a good woman—all are good, but some are better than others—and that she takes pains to fill his bucket with tasty food, that she studies to surprise him, that she does not give him the same old boughten drop cakes and the same old prune sauce over 489 days in the year, we will forget what is in the pail—we want to see the pail.

I have been hoping for over eleven years that some engineer would go into the tinsmith business or some tinsmith would ride on an engine regular for two months, and one or both of them go off into some vast solitude and invent a dinner pail that would make every engineer from Nova Scotia to the Sandwich Islands so proud that he would wear a plug hat on Sunday.

When I first commenced railroading, we had lots of time to eat at farm houses or village hotels, or if none happened in at the right time, we would stop and eat out of our baskets, pails, or paper sacks, each according to the dictates of his own conscience. But now-a days you have to eat on the fly, catch-as-catch-can, the fireman between fires, the bullgineer between stops or on long stretches, with one hand on the throttle, the other in his dinner pail, and his eagle eye on the rail.

When you could stop as long as you wanted to, and when you felt like it, wash up, take your dinner pail and get under a tree and eat till you were ashamed of yourself, it didn't amount to much whether your grub was in a basket, a haversack or a ten-pound lard pail. When you have to eat in dust and cinders, with the lily white on your hands not so lily as it used to be, it is of some importance how the dinner pail is built. The first dinner pail I bought was a deep round pail, with a sort of a canteen cover, with a screw top that carried the coffee in prosperity and smelt sour in adversity.

It would do for a careful man in the shop, but when Mrs. A. commenced at the bottom and laid the foundation of a lunch with a pair of ham sandwiches, laid up a few courses of rubble in the shape of stall-fed fried cakes, then underlaid the superstructure with three pillars of hard boiled eggs, erected a lamp-post of a long, slim cucumber pickle, finished the second story in fig cake, and surmounted the whole with a gorgeous, mansard roof of cream pie, it did look, feel, and smell "way up;" but bless you, after the old 71 got to dancing the racket for fifty miles, with that lunch in any box on the craft, it was a sight to behold—scrambled lunch, the fire-boy called it.

Then I got mad and squandered 75 cents for a "railroad pail," ventilated, to keep the lunch cool—and make your lemon pie look like it had been the bull's-eye in a fly-specking match—it had a tin coffee can in the shape of a brandy bottle, with a screw top; you could not get anything inside to wash it out, and after a few trips in hot weather, when the can was empty half the time, it got to smell like a hot-box; then if you took it out of the pail to warm it on the boiler head, the rest of the lunch slid into its hole, the pie tray would slide off its scaffolding and knock the pie into a cocked hat, and shove a pickled cauliflower into the tea-cup of strawberry preserves; if you took it in your lap and tried to eat, it was a jumbled mess. I had a grudge against one of the other engineers, and I gave him that pail and paid $1.25 for a copper one with a cup on top and a nickel-plated handle. This had a glass jar for coffee, and a tray that went over full size of pail; under the cup, on top of cover, was a sauce dish, and about once in six weeks Mrs. A would put something in this; as I always turned the cover upside down in my lap and fished out and assorted my lunch, strained honey or apple sauce often ran down my legs. I would have kept this one and said nothing, but the 71 laid down one day and rammed her starting bar through the copper bucket, and its precious contents, turned over the second time, and waved the wrecked pail aloft, and seemed to say: "Ah, there, John Henry! why didn't you eat at noon?"

Then Mrs. A. and I foraged the hardware stores, and marched home in triumph with a pail that had more good points than one, and some bad ones that we forgot about. It was made like the new cannon—on the built-up principle. It was made of sections of pressed tin pans, the bottom one being covered, and having a large screw top; this was for coffee. Then on top were three dishes that looked like pieces of pie, three-cornered—they were for vegetables—and when on top of coffee can made a circle; on top of these was a deeper dish for bread, etc., and on top of that another for pie, etc. A tin cup sat jauntily on top, like the gilded dome on the fabled temple of fame. The bail was eared to the bottom story, and ran up past the others and sprung into the sides of the cover. I could set it on the top of the boiler head, and when the coffee was hot the whole dinner was nice and warm. It kept out the dirt, but it looked like a tin store when all apart, and you had to get it all apart to eat. It would be great for the shop, but was too unhandy for the road. Some one stole it off the engine, and Mrs. A. discharged her hired girl because she had so much less tin to wash. Now I want a new dinner pail, and I want it made like this: A pressed tin dish, 8 inches across and 3 inches deep at bottom, with a top soldered on, and a 2 inch screw top to clean it by. On one side of this can I want another ½-inch screw top and a ½-inch tin pipe coming up outside as high as the handle, and extending down to within ⅛ of an inch of the bottom of can; it will have a cap on top. Then I want three sections of pressed tin dishes with the bottoms ¾ inch above bottom of ring, and bottom of each ring fitting over top of each dish. On one side I want tin hoops to fit over the pipe I spoke of, a cover with a loop on the inside of top for a spoon, and a bail coming from the bottom on side opposite pipe, and carrying handle at top and snapping onto pipe. With this, each kind of food will be by itself—let it shake; I can warm the whole lunch; I can pull off cap to pipe and drink coffee without disturbing rest of lunch, getting cinders in pail, using a cup or unscrewing a cap with dirty hands—my eye on the next town. I can take the whole pail in my lap, unsnap the bail and open any or all the sections by swinging them on the pipe to one side or the other. I can set the pail in the rain, the cinders or the dust, and it won't paralyze the lunch; it will be easy to clean, it wouldn't cost much, and while it might not be a conspicuous figure on dress parade, it would have about two weeks lap, and the right of the road for business.

JOHN ALEXANDER.

Handling Long or Short Trains with Air.

Editor The Locomotive Engineer:

In September issue, correspondent H. S. H., of Denver, Col, takes exceptions to statement in article on Air Brake Practice in August LOCOMOTIVE ENGINEER.

H. S. H says: "We can't just agree with one statement we find in it, that the reduction of air pressure necessary to make a stop depended on number of cars in train, rate of speed running, and kind of grade approaching stopping place. This is all right, excepting that part relating to number of cars. We would like to know what difference the number of cars makes as to reduction of air pressure in train pipe to make a stop. On a train of twenty cars it is necessary to exhaust more air than with five or ten, but the amount of pressure need not vary. We claim this on the ground that in each case, all things outside the number of cars are equal."

Now, referring to August LOCOMOTIVE ENGINEER, the matter reads: "Ordinarily with brakes in good order, a reduction of 3, 5 or 8 pounds air pressure, *according to number of cars in train*, rate of speed running, and kind of grade approaching stopping place, will give good results."

If H. S. H. pretends to say that the engineer should not take into consideration the number of cars in train, in handling air brakes, life is too short to say anything further on the subject.

The "Air Brake School Car" is a very good institution, but the theory set forth and knowledge gained therein must be modified and strengthened by practice on the road.

The problem of stopping a passenger train of six coaches, in comparison to stopping 15 coaches, descending a 40 ft. grade, would soon be solved in practice by the engineer watching effect of application on air gauge. Likewise stopping a train of 18 to 30 freight cars under similar conditions—economy of air supply, weight of train, etc., all taken into consideration.

If H S. H. would use *more* air without proportionate indicated reduction on air gauge, he would accomplish a novel feat, to say the least.

The reader will please bear in mind that general practice is treated of in my writing, and not the model in a school car or the perfect working train of quick-acting brakes with all recent appliances and improvements.

In direct answer to H. S. H., I would say, on a recent trial the difference in pressure needed to stop a train of 29 cars, compared to 10 cars, was several pounds more for the greater number. Again, on a train of 24 freight cars a reduction of 5 lbs of air did not set a brake, but a reduction of 8 lbs. set all brakes. Cutting the train to 10 cars, the 5 lb. reduction set the ten brakes.

The cause is clear enough; in handling the greater volume of air—as pressure is reduced by engineer's valve, it starts from forward cars first, and the space is filled on forward cars by air flowing from rear cars, and before triple valves will act it is necessary to have an even flow, and reduction started uniformly the entire length of cars or brakes in use. This naturally requires *more* air, more time in flowing from engineer's valve, and a consequent and proportionate reduction in pressure on air gauge.

This relates particularly to old style brakes.

We would repeat to those interested, always take into consideration the number of cars in train; in using air brakes with a heavy train, especially on a descending grade, add slightly to reduction to make sure of effective work; heavy tonnage, notwithstanding increased brakes in proportion, will need accurate management at a high rate of speed on a descending grade, where one cannot afford to experiment in releasing and resetting brakes, and ordinarily cannot afford any number of brakes not setting in proper manner.

To H. S. H. we would say, please don't graduate after taking a few lessons in an "Air Brake School Car." We endeavor to know and fully understand what we are writing about, and always stand ready to gain knowledge and take pointers that point toward correcting error. But always be sure you are right before shedding printer's ink.

J. E. PHELAN.

Brainard, Minn.

Novel Exhaust Nozzle.

John Y. Smith, the inventor of the ejector for vacuum brakes, has spent considerable time of late over an exhaust stand that works on the same principle as does his ejector, the exhaust steam issuing from openings surrounding a pipe open at the base to the smoke and gases in the front end.

There is no petticoat or draft pipe used, all the functions of this appliance being a part of the nozzle casting. There are several of these in use on a New England road, having done good work for the past four months with an exhaust nozzle opening larger in area than the steam ports in the cylinder. We will illustrate this device in our next issue.

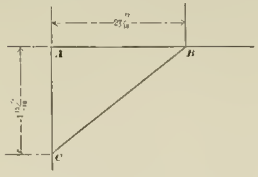
Combined Capacities.

To ordinary people twice two are four, but to mechanics twice two is often about $2\frac{3}{16}$. Some years ago a very successful M. M. received an order to "double the capacity" of a line of pipe that supplied a water tank, and, on finding that the pipe in use was two-inch, he ordered several hundred feet of four-inch piping to replace it. The superintendent of machinery o.k.ed the order, too, but a draftsman had to stumble onto the blunder, and "had the laugh on the old man."

There are a good many young mechanics and railroad men who do not know that to double the diameter of a circle increases its area four times, and there are a lot of other and older mechanics who do not know how to figure out the combined capacities of different sized pipe, cylinders or shafting, especially if the sizes end in fractions of an inch.

C. L. Redfield, a correspondent in the *American Machinist*, gives a graphic rule that is simple and easily remembered, and one that should be "pasted in the hat" of all young mechanics. Mr. Redfield says:

"Let us suppose that we have two pieces of shafting, any definite length, one piece $1\frac{5}{16}$" diameter, and the other $2\frac{7}{16}$" diameter; required the diameter of another piece of shafting, same length, which shall have a weight (or tensile or compressive strength) equal to the combined weight of the first two pieces. How many persons, draftsmen or others, are able to give this answer in one-half a minute, without the use of any tables? It is, nevertheless, the simplest kind of a problem. The whole question is simmered down to finding a diameter which has an area equal to the combined areas due to the diameters $1\frac{5}{16}$" and $2\frac{7}{16}$". We know that areas are to each other as the squares of their diameters, but the squaring of such numbers as $1\frac{5}{16}$ and $2\frac{7}{16}$ makes the ordinary draftsman inexpressibly weary. The graphic solution is shown in cut. Draw the lines *A B* and *A C* at right angles, and lay off on them



the distances $1\frac{5}{16}$ and $2\frac{7}{16}$ at *C* and *B* respectively, then will the distance between these points be the required diameter. * * It is not necessary to have paper and pencil to work this solution, as the square corner of a board and a two foot rule will answer every purpose."

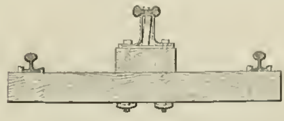
Brazilian Mountain Engines.

Probably the steepest and crookedest road operated by traction locomotives is the Cantagallo Railroad running from the city of Rio Janeiro to the coffee plantations on the elevated plateaus of the coast range.

This road has a grade of 8.3 per cent. (438 feet per mile), and curves of 131 feet, or 43.8° radius; there is no straight track on the mountain section, the line being a succession of reverse curves—there being ninety-one curves of over 40 degrees radius in a little over two miles.

Prior to 1883 this road was operated by the Fell system, a central rack rail, and the locomotives were of Swiss or English build, and were in all shapes, using from one to four cylinders; the trips were made with no regularity, repairs were heavy, and operating expenses burdensome.

In 1883 the Imperial Government made inquiries of the Baldwin Locomotive Works about engines for this line, requiring that they draw up this grade a train



of 40 gross tons. These works proposed to build and guarantee locomotives for this work that worked by traction alone, but used side bearing wheels on the center rail to help curve, and that used a steam brake gripping the central rail. Three engines were accordingly built, and were of the following dimensions: Cylinders, 18"x 20"; six driving wheels connected, 39" in diameter; wheel base, 9' 6"; boiler, 54" in diameter, with 190 flues, 2" diameter, 10' 9" long; and with side tanks, carried on the locomotive.

It will be seen that this calls for a very heavy engine with large cylinders on small wheels, and with a very short wheel base.

These engines have had several years trial and proven a complete success, so much so that these works are now building more of the same class for them

On this page will be found a diagram of the rail arrangement; the gauge of road is 3' $7\frac{1}{3}$", and the side faces of the center bearing rail are about five inches.

The curves on this road are so short that when three cars stand on them the two end ones are at right angles to each other.

Railroaders in Politics.

Committees from the five great organizations of railroad men—engineers, firemen, conductors, brakemen and switchmen—have met in Chicago and organized for political action. They propose to all railroad men in the State to cut loose from all old party affiliations and elect to office only men who will pledge themselves to help to repeal all conspiracy laws that menace constitutional rights of citizens; the repeal of the co-employe act, under the provisions of which, if one employe is injured through the carelessness of a co-employe, he cannot recover damages; the abolition of all private armed bodies under the direction of so called detective agencies. They also wish to have laws enacted that will benefit wage workers in general.

There can be no question as to the justice of the reforms asked, of the necessity of action or of the right of railroad men to move for better laws, or against bad ones.

Inhuman Practices.

On the 14th of August there was a wreck on the A & P., near East Siberia, in the California desert, all the cars of a passenger train being thrown down a 30-foot embankment, injuring many people. The mail clerk telegraphed for assistance, but the company owning the only wire, it refused to send a single dispatch for the passengers—even to tell their friends that they were all right. The passengers were picked up by the superintendent's train twelve hours after the wreck. They got up a series of resolutions, signed by every one on the train, condemning the officials who run cars unfit for service, and for inhuman treatment in refusing use of wire to allow them to relieve their friends of anxiety

It has long been the custom to treat passengers in this way, and if the A & P. can get any satisfaction out of the wholesale publication of such resolutions as those passed they are welcome to it.

This kind of work will only result in a national law compelling companies to furnish such reports as they themselves receive, to anxious friends of passengers and employes.

What did the wife or mother of that engineer or fireman suffer, knowing that he was twelve hours late, and that there was a wreck about which she could get no news?

LOCOMOTIVE ENGINEER.

All communications relating to the business of this paper (except subscriptions) should be addressed .

THE LOCOMOTIVE ENGINEER,

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☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

Hasty Judgment.

There was a strike of ten hours' duration on the Peoria, Decatur and Evansville road the last of August, the cause being the alleged hard treatment of the men by Master Mechanic Smith. Mr. Smith was himself a brotherhood engineer, and took hold of the road less than one year ago.

In reply to a letter one of the officials of the road says: "Mr. Smith succeeded in running our engines 38 miles to the ton of coal, as against 26 miles, the best we had done before. He got 24 miles on the same amount of oil we formerly made 15 on, and reduced our shop expenses at least 25 per cent. He discharged several men for drunkenness, and otherwise improved the service. Charges against him were preferred, and a reinstatement of the men discharged demanded, while he was at home attending a sick child which died before he got back to Mattoon. Mr. Smith resigned because his former employers, Schoenberger & Co., Pittsburgh, offered him a much higher salary than railroads usually pay for the service he performed. So far as we know, he was strictly temperate while here."

On the other hand, the enginemen declare that Smith was a habitual drunkard, and abused the authority invested in him.

Whether Mr. Smith, or the engineers, or both, are at fault we shall not presume to say, but we do know that there is lots of unfair, underhanded, and unmanly work generally done on both sides in a case like this.

If Mr. Smith got drunk he had no right to ask his men to keep sober, and the engineers had no right to get drunk because Mr. Smith did.

Any road that employs a drunkard as an engineer is a dangerous road to ride over; any engineer who demands that a drunkard shall be kept in road service displays poor judgment, a disregard for the good name of his own calling, and criminal carelessness of life and limb.

There are a whole lot of engineers in this country who would rather go on a committee to the general officers, than to just try to see if they could run on less oil or less coal. When engineers find that they have a master mechanic who wants to reduce the consumption of coal, makes improvements in the engines, with that result in view, and asks the engineers to help him, how is it going to hurt them to enter into the spirit of the thing, and try to run on less fuel?

The engineers should put themselves in the master mechanic's place and look at the matter as he is obliged to see it, and, on the other hand the master mechanic should know under what circumstances and disadvantages the engineers work, and not ask for impossible service.

We are sorry to record such trouble as this, as we hope to see more engineers promoted to positions of trust, but when the engineers themselves, instead of helping up those of their order who get a chance, strive to keep all on a common level—the best only equal to the poorest—there is little hope for the promotion of merit or ability from the ranks.

We only use this instance as one case in a thousand. Mr. Smith may be wrong; the engineers may be wrong. Such actions on the part of the men only tend to hasten the day already talked of, when engineers will run for so much per mile paying for their own coal and oil—then the man who is a "good enough" engineer will get paid in proportion to what he really earns the company, while the man who is a careful, painstaking man will get paid for his care and his pains.

No man ever did wrong in defending himself or his fellows against despotism or oppression, but are we always just and fair in deciding that we are right and the other fellow wrong? Do we do as we would be done by? Do we put ourselves in his place? Think about this.

Educating Scabs.

In the *Locomotive Engineers' Journal* for both August and September there were correspondents who objected to the system of asking questions and giving answers in the Road Department, for fear that answers might "educate the scabs" on the Q.

Such a policy would be like stopping all the lines of travel from New York to Chicago, to prevent anarchists of the Johann Most type from reaching that city. To be sure such a policy would be a great injury to 10,000,000 people, but it would keep back the anarchists.

The trade, or art, or profession of running a locomotive cannot be learned from questions and answers; actual experience on the footboard is necessary. Questions and answers, if practical, will help any man to a better understanding of his business—you can't teach a scab, or any other person, how to set eccentrics if he don't know where they are, or what they are for. Engineers, as a rule, don't ask where the smoke-stack is or which way you point the lever to go ahead or back.

There are many men now scabbing on the "Q" who are good men with an engine; those who are sober know as much about the business as average engineers, and questions and answers will do them as much good as others with more principle.

The conductors, and brakemen, and roundhouse and cornfield chaps that are stopping and starting Q. scraps for the time being, have not had the experience and do not know enough of the rudiments of the business to profit by any questions an intelligent engineer would ask—an engineer who thinks so acknowledges that he is a numbskull at the business.

The Engineers' Brotherhood has done good work in the past in purging the order of drunkards and incompetents; it has also purged itself of many first-class engineers who did not think as the majority did. There has been lots of spite work in the past that has set adrift many able engineers with a grievance against the order. Look at the expulsions every month. Can any of us claim that men expelled for non-payment of dues are not good men with locomotives? They may have been in the order for years

We must not choke off sources of benefit and information to the tens of thousands in the ranks, to prevent a few men from "getting posted" who are fast bankrupting their employers, and will soon put the eternal kibosh on themselves.

We might as well talk of closing the public schools for fear they would put information into the hands and heads of rising youth, who would be enabled thereby to eventually become painters who desecrate nature with advertisements of the best soap, or forgers of school scrip or bank checks.

Creating Locomotives.

We see the item about the building of a locomotive in 16 hours 50 minutes, at the Altoona shops, still being copied far and wide. No locomotive was ever built in as many days. The Altoona engine was merely partially assembled; the frame was all together, the cylinders fitted, valves in chest, tumbling and rock shafts up, spring hangers and boiler braces on frame, guides up and crossheads lined, before the 17 hours' work commenced. It may be of interest to real railroad men to know the practice at the Baldwin Locomotive Works, the largest locomotive shops in the world. In usual practice it is six weeks at the least from the time an order with all specifications is received before an engine is ready to ship.

It takes from three to four weeks to make an ordinary locomotive boiler, but they have made them in two weeks—can't get men enough around one to finish them any sooner; it takes from three to four days to do the flanging alone. It takes from one to three days to properly fit a pair of cylinders to the boiler. The idea of *building* a locomotive in 17 hours is just as absurd as the idea of making a three-year-old colt in a minute. The Pennsylvania record was a good one for fast work, and they got the engine together in 17 hours by having more than half the assembling before they commenced to count time.

Poor's Manual of Railroads.

Poor's Manual of Railroads is out for 1888, and one has been placed at the disposal of THE LOCOMOTIVE ENGINEER. This is the 21st annual number, and is replete with information about our railroads. It contains a statement of all dividends paid from 1880 to 1887; a table giving the range of stock values for two years; the State debts; and a complete list of officials.

The road statements state name, location, length of lines operated, length of sidings, gauge of track, weight of rail, number of engines, number of each kind of cars, and a complete history of the road—debts, earnings, operating expenses, list and addresses of directors, time of their meeting, and anything else you want to know, except when the trains leave. The book contains upward of 1,400 pages, containing many maps, and is invaluable to anybody hunting for railroad statistics.

A Well-Earned Vacation.

A Pinkerton detective was hired, so says the *Conductors' Monthly*, by the general superintendent of the Mexican Central R'y, to act as a spotter, and, disguised as a brakeman, proposed to a couple of conductors to rob cars. They acquainted the Jefe Politico (Chief of Police) of Silao of the offer, and he directed them to go ahead and do the robbing, which they did, and the trio were roped in by the alert Jefe, and the Pinkerton man got a well-deserved sentence of 13 years in a penal settlement in Yucatan.

Supt. Mackenzie gave his evidence before the court to get his spotter out of the scrape, and the astute Judge is credited with replying: "No; if all that you tell me is true, this man has been guilty of a heinous conspiracy, trying to encompass the ruin of two innocent men, and I can perceive no mitigating circumstance in anything you say. He will have to go to Yucatan. If I were to do my whole duty I would arrest you on the spot, and have you tried for participating in the conspiracy. I shall most certainly do so the next time you try anything of the kind."

If this be true, the Mexican Judge is entitled to a monument of bronze at the hands of American workmen.

The *Conductors' Monthly* is highly pleased over this case, because the men whom the crime breeder tried to ruin were conductors.

The same paper has been for months aiding, abetting, and giving moral encouragement to the C., B. & Q. management in its employment of a young army of Pinkertons, to plot against the life and liberty of engineers, firemen and switchmen. It makes a world of difference whose ox is gored.

Protection Needed.

When the Brotherhoods of railroad men federate—which they soon will—it will not be long before organized labor, from the rock-bound coast of Maine to the shining sands of the Golden Gate, will have a common grand council. Processes of enlightenment will then be inaugurated, that will relegate strikes to the scrap-heap of oblivion, and battles of right and wrong will be fought with the ballot.

When that time comes—and pray God it come soon—the first duty of American workmen will be to elect men to office who will pledge themselves to purge this fair country of that species of venomous reptile known in Ireland as informers, in France as secret servants, in Russia as messengers of the Imperial Tzar, and in America as spotters, or Pinkertons.

That one man, or number of men, can hire at fixed rates, perjurers, liars, or assassins, to prey upon the life, liberty or happiness of other men, is a blot upon our boasted freedom that sorely needs the attention of every honest voter.

If there is any protection needed in America, it is protection from the thousand lurking vipers from within, rather than the few crazy anarchists from without.

It is the opinion of many of the ablest engineers in the country that the strike should be declared off on the C., B. & Q. road, and a chance given to many of the old men to get their places back, and the rest to seek and find employment before the winter. There is little hope for success, and the longer they wait the more experience the scabs are getting. We are in full sympathy with the men, and have hoped that the whole trouble would hinge upon rates of pay, and that they should win; but they cannot win, and the next best thing is to stop the strike and get work if possible.

We believe that if there had been less of this "follow the leader" and "hurrah boys" business, and every ballot taken was a secret one, the strike would have been off long ago, and most of the men at work again.

The "Q" is a wreck, and no manager, fair or unfair, wants any of the medicine Stone has taken, but it is doing the brotherhoods no good to stand idly by holding the empty bottle.

Alexander's Ready Reference is a little pocket book, telling engineers and firemen what to do in 101 emergencies that arise in the shop and on the road; this work has been on the market several years, and has met with a large sale. Mr. Alexander has now published a key to the Ready Reference, or The Reason Why, as he calls it. It is bound like the former book and will be of great help to those who want to know the "why."

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While the editors of *The Railway Service Gazette* and the *National Labor Tribune* were on their respective vacations, the editors *pro tem* copied articles from THE LOCOMOTIVE ENGINEER without credit. We hope the real editors will soon return.

***

Light, Heat and Power, the ablest gas journal in the country, has become a weekly. We hope she will meter success.

ASKED & ANSWERED.

(57) Pop, North Platte, Neb., asks:

How many coils should there be in a safety valve spring? *A.*—Rose says a good spring for marine safety valve should contain 14 coils. We have never noticed any valves made for locomotives having more than eight coils.

(58) M. B. O., Sheldon, Ia., writes:

In your July number you explained that center of cylinders was above the center of drivers. What is this done for, and has it any effect on valve motion? *A.*—See question 16, in April number.

(59) Y. M. C. A., N. Y. City, writes:

My engineer claims that steam is steam, and that after water reaches the boiling point (212°) and commences to give off steam, its temperature does not increase with the pressure. I claim that the degrees of heat increase directly with the pressure and that steam at 100 pounds' pressure is 312° heat. Who is right? *A.*—Neither one of you. Steam at atmospheric pressure is about 213 Fahr., at 50 pounds' pressure the heat has increased to 298, at 100 pounds' pressure to 338, and at 140 pounds' pressure—usual locomotive practice—360° Fahr.

(60) J. T., Chicago, writes:

Some time ago you described or mentioned the steam reversing gear in use on the Pennsylvania and on the Reading roads. Do you think that, with the increased size of cylinders and valves, the steam reverse gear will come into, or should come into, general use? *A.* No. The invention of a successful balancing device for locomotive valves has done away with the necessity of a steam gear. They are expensive and have many parts liable to derangement. The simpler all locomotives are, and still made to meet all requirements of standard service, the better it is for the locomotive, the engineman and the railroad company.

(61) H K ——.

Send description of your three-cylinder engine; also your full address.

IN THE ROUNDHOUSE AND REPAIR SHOP.

The Old Colony road have adopted the Dean guide.

* * *

The Pennsylvania Railroad uses about 8,000 tons of coal per day.

* * *

Over 2,500,000 passengers per month are carried over the Brooklyn bridge.

* * *

The Central Railway of New Jersey are receiving a number of new freight locomotives with the Wooton fire-box.

* * *

The Inloes safety turn-table lock has been adopted by several Southern roads, and appears to be giving satisfaction. Mr. Inloes will exhibit his lock at the Paris exposition next year.

* * *

At the Wyoming shops of the Vulcan Iron Works, Wilkesbarre, Pa., the yearly output, aside from mining machinery, is about thirty narrow gauge locomotives. One is just now being shipped to Brazil.

* * *

Engineering, London, states that there are boilers on locomotives in the United States with 5' 4" boilers. Since this news has got over there and back we have a number of locomotives with boilers whose smallest ring is even 6 feet.

* * *

Engineer Herman E. Willis, of Clinton, Ia., has been nominated for a place on the Railroad Commission of Iowa. We hope brother Willis will get there. Iowa is just now in need of a railroad commissioner that possesses ordinary horse sense.

* * *

The Cooke Locomotive Works, of Paterson, N. J., will build new shops in a portion of the city where they can have all the room they want. They are crowded for room in their present quarters, and the new ones will have every modern convenience for the work in hand.

* * *

At the P. & B. C. roundhouse in Philadelphia they are removing the heavy iron columns between the doors and replacing them with small wooden ones—the old openings were too narrow for the big Pennsylvania engines that are now used on the line. This seems to be a better plan than flattening the sides of cylinders, as the Reading did some time ago.

* * *

The old locomotive "General," illustrated in our August number, was off on a vacation at the soldiers' re-union last month, at Columbus, O. She was accompanied by her engineer, Jeff. Cain, from whom she was stolen, and Captain Fuller, who recaptured her. She met the survivors of the raid that captured her, and—we hope—had a good time with the boys from North and South.

During last year 988 miles of road were completed and opened in India, making a total of 14,388 miles open. At the end of March the total sanctioned mileage of railways open and in course of construction was 16,870 miles.—*Ex.*

* * *

The Hartford & New Haven R'y have no hand rails or running boards on any of their engines. If you want to go out in front, you stop and walk around on the ground. We don't just understand how the boys get around to clean their engines.

* * *

The train ticket agent seems to have come to stay, and is being introduced on many roads. That they are a safeguard there can be no doubt. Let the conductor look out for his time card and orders, and be sure that the brakeman gets back far enough when he flags.

* * *

This office is in receipt of a letter stating that a gentleman recently counted the mile posts from an Erie train, and that the train made 96 miles an hour for 90 minutes. Guess the gentleman in question was counting whistling posts, road crossing posts and mile posts all together.

* * *

The Philadelphia and Baltimore Central folks hold their solid-ended side rods on by using a large-headed bolt that goes through pin and is held by check nuts from the inside of wheel; the bolt head looks for all the world like the collar of an ordinary pin, and it has bothered many railroad men who were not "on," to see how they ever got the solid rod over the solid collar.

* * *

When the Locomotive Firemen's Brotherhood undertake anything, they generally strike out for something new, original and good. Their "souvenir," or programme, of the 14th convention, held this month at Atlanta, Ga., is not only a work of art and tastefully gotten up, but contains illustrations and reading matter of interest to any railroad man, and, being bound and engrossed like a volume of poems, it will be preserved. This is the finest thing of the kind we have ever come across, and the committee who sent it out deserve great credit.

We are in receipt of the programme for the twenty-fifth annual convention of the Locomotive Engineers' Brotherhood, to be held at Richmond, Va., October 17th. It is the largest and handsomest programme they ever issued, and reflects credit upon the committee having it in charge. The first line on the cover reads: "Come, let us reason together." We hope the engineers will do lots of this at Richmond—there is need of it.

* * *

On the night of September 4, an express train between Dijon and Paris, France, left the rails, and another express dashed into the wreck. Forty persons were killed. Something wrong with the block signal here. Why would it not be in the line of reason and progress for European roads to adopt good automatic brakes and American roads good block signal systems?

THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

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The Elevated Accident.

A short time ago all New York had a shiver over an accident on the Ninth avenue elevated road. A train was taking a side track—something not usually done—when another train came along and ran into the side of it, derailing cars and throwing a truck into the street. The daily papers stated at the time that one of the automatic signals was broken and tied up with an old rope. Investigation does not prove this.

In every accident some one is to blame—sometimes the operatives and sometimes the management, and often both. In this instance it was plainly the engineer; he was simply not attending to his duty, and ran into the train with the signal dead against him. One of the hardest things the "L" roads have had to do is to keep their enginemen from looking into the windows along the road and keep their eyes on the track and the signals. The only way we see is to build cabs so constructed that men can see ahead and back only—this would be inconvenient, but it would keep the men from looking where they should not. Another way would be to keep shutters closed and prohibit good-looking females from using streets traversed by the "L."

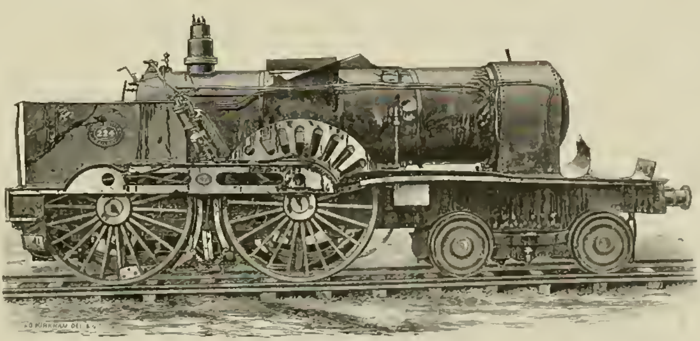
The English Board of Trade, a government institution, has asked all railroad companies in the United Kingdom to furnish a record of all railway employes who were on duty—in any instance, during the year—for 12 hours. Why should England lead in passing laws to prevent accident by reducing the hours of labor?

A Reverse Lever for Air Pumps.

"Do you see that piece of tin on the front door there?" asked a Michigan Central engineer as we sat up behind him not long ago. "Well, I'll bet you $400 you can't guess what it was for." We did not have the change, so he gave it away for nothing. "When the air brake first came out, I got one of the old-fashioned pumps with the valve tappits outside, and it used to have a habit of stopping to rest, and I had that hole bored there to punch it up with a stick in cold weather. I had an old piece of broom handle for a 'prod,' and would as soon think of going out without the smoke-stack. I kept that pump, too, until the madam went in the shop last year. I had a comical genius of a fireman, who named the stick the air pump reverse lever."

Many roads that have for years built their own locomotives are abandoning the practice, finding that they can buy better engines, built to standards, for less money and in shorter time than can be built at home.

There were 40,188,000 railway passengers who arrived or left New York between May 1st, 1887, and May 1st, 1888.



TAY ENGINE.

Historical Locomotives.

FOURTH SKETCH.

We present to our readers with this paper, some illustrations of an engine with a sad history—the one that took the plunge into the Tay, Scotland, when the great bridge that crosses that arm of the North Sea went down.

The bridge over the Firth of Tay—between Newport, on the south, and Dundee, on the north—was commenced in 1870, and the first locomotive passed over it Sept. 22d, 1877, and it was opened for traffic the following May.

The bridge was nearly two miles long—10,350 feet—and consisted of 85 openings, eleven of them being spans of 245 feet. All but one were of the form known as lattice girders.

The bridge was not straight, but built on a curve of 30 chains, 1,980 feet radius, and the tracks were 88 feet above high tide.

The bridge carried a big traffic, but being a single line of rails, was worked on what in Europe is called the "staff" system. There is a brass rod, and only one, and the engineer who proceeds over the staffed track must have the staff, and if he does he knows that no other train is on the line. At this bridge the trains slowed down to three miles per hour, to receive the staff, but it was proven that they ran as fast as 35 miles per hour over the bridge, the authorized speed being 25.

This bridge cost £350,000—over a million and a half of dollars, and was the property of the North British Railway Co.

On the night of Dec. 28, 1879, during a

fearful gale of wind, engine 224, pulling seven passenger carriages, slowed up on the south side, received the staff, and proceeded toward Dundee. Several people saw the lights of the train disappear, but neither the engineer or fireman, or one of the seventy passengers behind them, ever lived to tell how the accident happened.

Thirteen of the central and largest spans of the bridge fell—eight of them ahead of the engine—so it would seem that the storm had a hand in the disaster.

Probably no railroad wreck ever happened that was more widely known and deplored, the world over, than this. There is something appalling about the utter annihilation of a crew and train of passengers, that does not attach to wrecks where some escape to tell the tale.

The large illustration shows the general design of the engine. She is an 8-wheeler, inside connected, 17x24, driving wheels 6 feet 7 inches in diameter; the reverse lever is not common in Europe, but is employed on this road; engine had Westinghouse air brakes; as will be seen the boiler is domeless, copper fire-box, brass flues and straight stack. The rear view shows the chains and tackle used by the divers to raise her, and the pictures here shown are from photographs taken on the Dundee docks the day the wreck was raised by Messrs. Valentine & Co., of Dundee.

Keen-eyed American enginemen will notice the peculiarities of construction, though this engine is more on the general plan of locomotives in the United States than any European-built engines we have ever seen.

In the photograph furnished of the back end of engine the reverse lever is shown upon the left side. This was reversed in engraving. Mr. Angus Sinclair, author of "Locomotive Engine Running and Management," who commenced his railroad career in Scotland, tells us that locomotives are built with the reverse gear on either side, generally the left. It is the custom there to run upon the left-hand track, on double track; teams and pedestrians turn out to the left in meeting, just as they do to the right here.

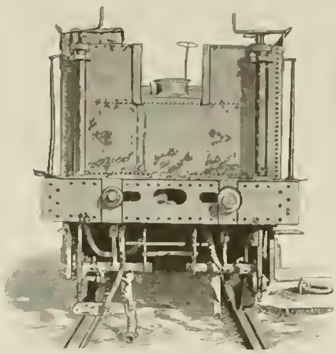
The tank view shows the heavy, double-screw brakes, and their mode of attachment, and also the peculiar construction of the coal pit, being high and small, while the water space is proportionately large.

We are under many obligations to Mr. Matthew Holmes, superintendent of locomotive and carriage department, North British Railways, Glasgow, Scotland, for data and drawings kindly furnished for this article.

"The railroads of the world are to-day worth from twenty-five to thirty thousand million dollars. This probably represents one-tenth of the total wealth of civilized nations, and one-quarter, if not one-third, of their invested capital."—Arthur T. Hadley *in Scribner's Magazine.*

An Internal Railroad.

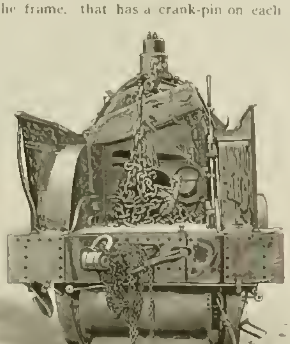
Many railroad men "from the country" have been surprised to run onto an immense freight depot in the heart of the district devoted to wholesale houses in New York city, while passengers only come in as far as 42d street, fifty blocks further north.



Tender, Tay Engine.

The N.Y Central has an immense freight depot at Beach street and West Broadway, and cars from all over the country are there switched back and forth by a number of mongrel locomotives. These locomotives are small, geared, dummy engines, on four small wheels; they are boxed up like a car, have upright boilers, and a reverse lever and throttle located at each end of the machine; the levers and throttles work together, and the runner always changes ends when he wants it to go the other way, there being a link on the reverse lever handle, that locks the latch out of gear with the quadrant on the lever not in use.

The power is transmitted to the drivers by a geared master shaft in the center of the frame, that has a crank-pin on each



Rear View Tay Engine

side, from which independent rods go to each driver.

The cars are hauled over tracks laid down Canal street to the docks, thence along the Hudson River to 30th street, where they are handled by ferry.

The streets through which these engines handle their trains are crowded with traffic, and the goats never go out of the building without a flagman ahead of them; and, in starting off to deliver cars at the end of the line, the man with the red flag rides a bay horse in front of the rushing train, that has its rush tamed down very considerably.

Steam Pipe Repairs.

In a recent conversation with two experienced roundhouse foremen, we found that, while one did a lot of work every year on steam pipes, the other rarely had to grind one in, and claimed that leaks were the direct result of abuse at hands of engineers, or too weak bolts in putting up.

Drifting into the cost of grinding in steam pipes, they differed greatly, and finally asked The Locomotive Engineer to propound the following questions to the roundhouse foremen of the country, and "average the verdict."

1. As a general rule, how often do you grind in the steam pipe joints on engines in regular service?

2. Have you any special tools for it? If so, what?

3. Do you keep a machinist and helper for this work, with tools for it, etc., or do you make the men take their turns at it?

4. How long does it take to grind in joints in front end?

5. Do you, as a rule, make the engine lose a trip for this work?

6. Do the engines on your road have relief valves on chest, to prevent overpressure in chest and pipes when engine is reversed? If so, has it cut down the work on pipes?

7. Do you note any difference between passenger and freight engines?

8. Do you use a clip or bridge over lower joints, in addition to regular bolts?

9. Do you notice any difference between pipes in extension and short front ends? Which lasts longest?

10. How much does it cost to grind in the four joints?

Our friends in the roundhouses and shops will be contributing to the knowledge of others in the same walk of life, and may call out kinks of use to themselves, by answering as many of the above questions as they can. A comparison of work can but benefit all.

It is a notable fact that the big engines being turned out for fast passenger service far and near, are, in a great many cases, keeping their driving-boxes about as hot as they do the fire-box. When we get over 15,000 pounds on a driver we are pretty close to the limits for cool boxes and fast time; if heavier mills are needed to make the time, it will pay to put another pair of wheels under them. Whether it is better to run such heavy trains and heavy engines, or to run more and lighter trains and lighter engines with but a single pair of wheels, is an open question.

A Modern Boiler Tester and Washer.

A few years ago it was a 10-hour job to get a locomotive boiler blown off, properly cooled down, washed out, filled, and steam raised again.

The demands of service have made it necessary to cut down this time, and, as it could be done in no other way, the time for cooling the hot sheets of the boiler was cut down till the limits of safety were reached, and, in many instances, passed.

At the shops of the Philadelphia & Baltimore Central R. R., at 16th street and Washington avenue, Philadelphia, engines are taken in, blown off, washed out, filled, fired, and cross the table in one hour, and without danger to the boiler.

This is accomplished by a simple arrangement of injectors on the stationary boiler, and the use of hot water instead of cold, both to wash out and re-fill the boiler.

H D. Gordon, M M of this road, now a part of the Penna. system, has designed the washer and tester shown in our engraving. The apparatus consists of two common Rue injectors—non-lifter—and the arrangement is clearly shown and all sizes given in engraving, so that any master mechanic can make one without other drawings. The large injector is used to wash out and fill up the boiler, and, as the demands upon it are not so great as if it were feeding a boiler under pressure, its delivery tube can be enlarged or its steam tube diminished, causing it to throw a larger quantity of water in a short time.

In practice the boiler is blown off and water run out, and the big injector put to work on the wash-out hose; this can be done at once, as the water is hot. As soon as the boiler is washed the plugs are inserted and the hose attached to the blow-off cock or the feed pipe of an injector, and the boiler filled with hot water.

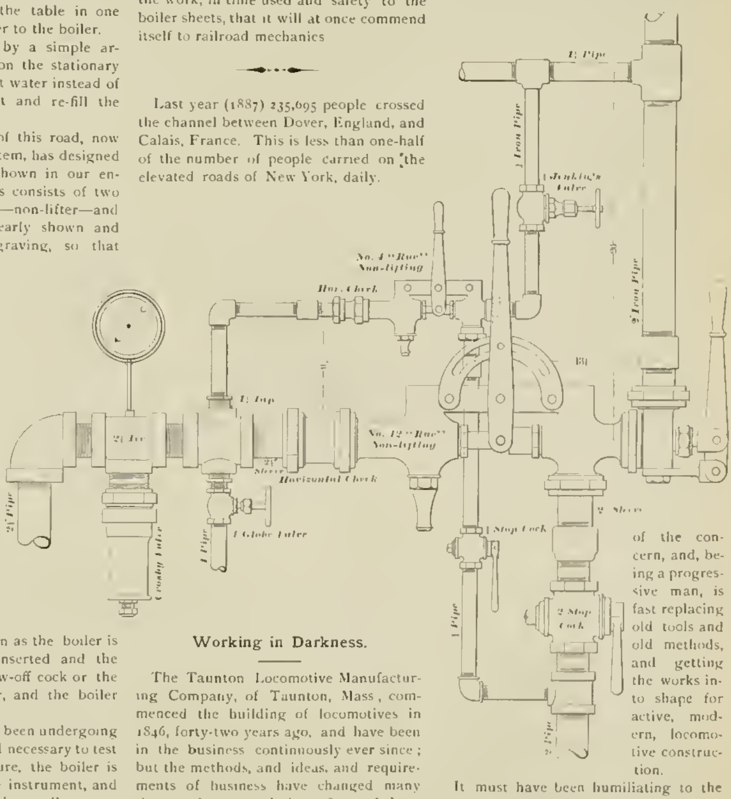
Should the boiler have been undergoing repairs, and it be deemed necessary to test it with hydraulic pressure, the boiler is filled full with the large instrument, and it is then shut off and the small one put to work; this injector is required to throw but a small amount of water, but against great pressure, and the nozzles are especially arranged to accomplish this result.

This device places the whole affair under the hand of the man who is manipulating it; the gauge tells the pressure on the boiler, and the large, inverted, Crosby pop immediately under it, prevents the pressure from reaching a dangerous point, should the tester neglect or forget his work

In testing, it is often desirable to reduce the pressure for an instant, or hold it temporarily at a given point without shutting off the feed. This is accomplished by using the small globe valve shown under the delivery connection of the tester to the main water pipe.

The Rue Injector Co. make a tester and washer, all in one casting, that accomplishes the same results as does this arrangement, but in the shop mentioned the large injector was already in use as a boiler washer, and the small instrument for some other purpose, so it was decided to utilize them.

The device costs so much less than a steam pump to wash, or a test pump to test, and is, withal, so much superior for the work, in time used and safety to the boiler sheets, that it will at once commend itself to railroad mechanics



Last year (1887) 235,695 people crossed the channel between Dover, England, and Calais, France. This is less than one-half of the number of people carried on the elevated roads of New York, daily.

Working in Darkness.

The Taunton Locomotive Manufacturing Company, of Taunton, Mass , commenced the building of locomotives in 1846, forty-two years ago, and have been in the business continuously ever since; but the methods, and ideas, and requirements of business have changed many times and very much since 1846, and those who did not keep in the current have been swept into eddies of inactivity—this has been the fate of the Taunton Locomotive Manufacturing Co. Men get old and slow, and unless they read and interpret the signs of the times correctly, they do not keep up with the march of improvement They keep old shops and old tools, not because they are as good as the best their competitors can have, but because of the good they have done in the past. A chain-feed lathe will insist on a chain-feed mechanic, and both will only turn out chain-feed work.

Twenty years ago the company cited had as good a plant, and did as good work and as much work as any other concern in the country; all was well then, they let well enough alone—there is no such thing as "well enough" in locomotive manufacturing. The old tools and old men kept at work on such business as early connections and personal solicitation would bring; time went on, letters dropped off the signs on the buildings, advertisements were withdrawn from the railroad press, and moss gathered on the reputation of the works.

Now a change has come; a new hand and a younger head directs the destinies of the concern, and, being a progressive man, is fast replacing old tools and old methods, and getting the works into shape for active, modern, locomotive construction.

It must have been humiliating to the new manager—and it certainly teaches a lesson on advertising—to be told, as he was this month, by an official of one of the Brooklyn elevated roads, that he had never heard of the Taunton Locomotive Manufacturing Co. This mechanic is not a novice in the business, but has long been connected with railroad work, and lives within 200 miles of Taunton.

The address of the president of the Master Mechanics' Association, J. H. Setchel, has been changed from Dunkirk, to Cuba, N. Y. Mr. Setchel has accepted a position with the Martin Anti-Fire Car Heating Company.

Locomotive Clock.

Locomotive clocks that will keep good time in this exacting service, and that can be bought for less than the locomotive itself costs, are a safeguard and a convenience that few engineers can afford to be without.

For some years our correspondent, W. F. Relyea, of Syracuse, N. Y., has been "fixing up" clocks for the engineers of the N Y. Central, and they have given such universal satisfaction that the firm of Becker & Lathrop, of Syracuse, have decided to put them on the market. Mr. Relyea's plan was to buy a first-class, Seth Thomas, 8-day works, with an enameled face, and put them into a steam gauge case. There are about 100 of these clocks, giving first-class satisfaction, some of them having run 12 years.

The new clock looks just like the ones sold for $20 and $25, and, the users say, are just as accurate time-keepers.

They have a six inch face, a heavy case of polished brass, with a front that screws on, dust and damp-proof They are beauties, and, being sold and guaranteed for the small sum of $10, we predict for them a welcome from the footboard.

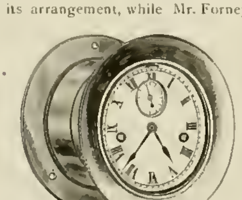
Firing Anthracite Coal.

FIRST PAPER.

Allow me to introduce myself, and show the reason why it appears that an article, or series of articles, on hard—anthracite—coal firing may not be unprofitable reading to the majority of your readers. As for myself, I am now running a locomotive, but as I have not been at it long enough to forget my trials and tribulations as a fireman, I still take a lively interest in the "boys" who handle the scoop, and hope to ever retain a fellow feeling for them, which, as the poet has it, "makes us wondrous kind." Seeing that for nearly ten years my name was on the pay-roll of our company as a fireman, six years of this ten was put in over the road, and nearly four years in the roundhouse; and I ought thus to know a little on the subject of hard-coal firing, as that is the only kind of coal used on our road.

Several years ago, a brother fireman, employed on the L. S. & M. S. R. R., in Indiana, whom I will call George Long, paid me a visit, and during that time I endeavored to show him whatever I thought might prove new and interesting; and in one instance at least I succeeded, and that was when I got on one of our hard-coal burners with him, as she was pulling a heavy train up one of our heaviest grades. The train was in motion on a nearly level section when we got on, but we soon came to a hard pull, and had a climb of sixteen miles ahead of us. I introduced Bro. Geo. Long to fireman George, whom we will call Short, and to the engineer and brakeman, and as the two firemen entered into conversation at once, I devoted a few minutes to the engineer. I soon noted that Bro. Long seemed inclined to stop talking to Bro. Short, and to get uneasy. At last he got a position where he could see the steam gauge, and found the pointer indicating 130 pounds (the maximum pressure), and still Bro. Short was ready to talk on. Bro. Long at last relieved his mind by asking me: "How long is this to keep up? When does he put in his fire?" I told him he would see pretty soon. The train moved on nearly three miles before Bro. Short shoveled any coal, and then he put in only three or four scoopsful, and with four or five more at another point, we made a run of eight miles from where we got on. At this point we stopped to take water, and while coming to the tank and laying there, Bro. Short "cleaned his fire," and then piled in the diamonds until Bro. Long thought he was never going to stop. Bro. Long had then fired some four or five years, but had never seen the like before, but still I thought his an isolated case of ignorance of "our ways," but I find that many more of the "rank and file" of firemen have no conception of hard-coal firing.

Mr. Sinclair, in his book on "Locomotive Running and Management," mentions a hard-coal burning passenger locomotive and its performance, but gives no dimensions of fire-box, and description of its arrangement, while Mr. Forney, in



LOCOMOTIVE CLOCK.

his "Catechism of the Locomotive," fails to give any cut or description of the hard-coal locomotive, or its fire-box and area. Mr. Forney, in giving the size of a "Baldwin Mogul" fire-box, gives its dimensions as $66 \times 34\frac{1}{2}$ inches. Our Baldwin Moguls measure 33 to 34 inches in width, by 8 ft. 4 inches, or just 100 inches in length, while the Cook Mogul fire-boxes are from 95 to 97 inches long; and the Dickson run as high as 9 ft. 1 inch, or 109 inches, while our Consolidation fire-boxes are 113 to 115 inches long. There is thus a great difference in the length of hard, as compared with soft-coal burning fire-boxes, as well as some difference in the construction of the grates. The grates of a hard-coal burner consist of a series of tubes called water bars, in connection with the water space in the leg of the boiler, and of two, three or four solid iron grate bars which are movable. Both series of water bars and grate bars extend lengthwise of the fire-box, and in the newly built locomotives are of a uniform level, but in some older types used to range up and down, thus giving a greater number of water bars. The water bars are of course immovable, being inserted in the water leg and fastened the same as flues; but the grate bars can be pulled out, and as the thimbles in the back leg of the boiler, through which the bars slide, are above the level of the tank floor, and the bars are provided with heads, it is an easy matter for the fireman to pull them out as far as needed in the manipulation of his fire. The number of water bars vary from six to ten, and, as stated, the grate bars range from two to four, inserted at regular intervals between the water bars, and not all in one place, as might be assumed.

The Baldwins differ from other locomotives in the fact that their grate bars do not slide, but are attached to a series of rocker arms, and these rocker arms are so connected, that the movement of a lever, having its connecting rod and handle in the left side of the cab, moves the whole set of bars out of the way by a side movement, leaving the space between the water bars and formerly occupied by the grate bars open, in the same manner as is done by pulling the bars out in other locomotives. Of course the water bars do not come so close as to touch, but have a space from ½ to ¾, and in some cases an inch, between them and their adjacent water or grate bars, forming spaces for the admission of the much-needed air. There are no fire arches, water arches or brick arches in use in our hard-coal burners, and only a few have a so-called combustion chamber at the front end of the fire-box. This combustion chamber is a recess between the line of the inside of front fire leg and the flue sheet. This varies from 6 to 12 or 15 inches, and is thought to produce a more perfect combustion of the gases before they reach the flues in their mad rush to the stack, and through it to the air. There are no dampers attached to the fire-box or ash-pan of these hard-coal burners. The only dampers the hard-coal fireman has to contend with, is the damper put on his gauge and spirits by the pump or injector, or the tongue of his engineer.

Another feature of the hard-coal burner is its ash-pan. As stated, in alluding to the grate bars, they are above the level of the floor; the front end on most of them droops a little, usually not over 4 to 6 inches. This brings the bottom of the fire high, as compared with a soft-coal fire, and leaves lots of room for the ash-pans, which are in reality small hoppers, and in the Moguls consist of two apartments, separated by the back axle. These hoppers extend downward to within 4 or 5 inches of the rail line, thus having capacity to carry a large quantity of ashes or clinkers, and they are often filled with the products of imperfect combustion of our sometimes very poor and slaty coal. These ash-pans have movable bottoms called slides, which move in suitable grooves, and are so connected to each other, and to a bell crank lever, that a pull on its connecting rod handle will allow the contents of the pan to run out on the road bed or the ash-pits. As the fire is cleaned a number of times during each trip, it is necessary to have places to dump the ashes at various points, indicated by sign-boards along the line; and this can of course be done while running, by simply actuating the slides, except in rare instances, where the mass of ashes and fire becomes baked together, and has to be broken up before it will fall out of the pan.

The door thus is the only means by which the hard-coal fireman can at all regulate his fire. In most all these locomotives the doors have one or more gas holes, fitted with slides, by means of which air can be admitted over the fire, and some doors also have ratchet latches, so that the door can be "put on the crack," accomplishing the same purpose.

Having now considered the hard-coal fire-box and its attachments, with the exception of the draft or petticoat pipe, which is, however, one of its most important helpers, and of which we may have more to say after a while, we will in our next take up the subject of putting in a fire. VULCAN.

Harpooning for Firemen.

W. De Sanno, an old-time engineer who used to run on the old State roads of Penna., has been contributing some interesting articles on early practice to the *Fireman's Magazine*, and, among other things, has the following to say of a special instrument for executing firemen:

Sand boxes had not come into general use, although sand was carried on the engines, or rather in a box on the tender. The sand pipes had a cup-shaped top, and the engineer and fireman each had a tin cup which they would fill with sand, and turn the cup to one side and let the jar of the engine shake the sand out. Cylinder cocks were not connected so they could be handled by the engineer, so it was part of the fireman's duty to jump off and run around the engine after she had started, and shut the cylinder cocks. In my first article I spoke of the front end getting red-hot. The stack mostly in use would look like the present diamond stack turned "t'other end up," placing the bulb next to the smoke-box. I think they were called the "Yankee" stack, or "pipes," as they were then called.

Petticoats were unknown; the exhaust pipes ran up to the top of the smoke-box and entered the netting, which was in the form of an inverted cone in the bottom part of the diamond of the stack. The smoke-box had nothing to help clean it out; the fuel was good wood and coal. The fireman would throw in about a dozen sticks of wood and then sprinkle a couple of shovels of coal over it; in consequence of no cleaning device in the smoke-box, the unconsumed parts of the fuel would collect there and ignite, and heat the front end to a cherry-red—the front end door was boiler iron—when they would stop for wood and water, the fireman would take water (there were no head brakemen in those days), unless some of us boys would jump up and take water for him (which water act the writer has often performed). While water was being taken, the fireman would clean out his ash pan and then go around and hoe out the front end, or there was no steam; so you see, boys, the man on the left side had no time to flirt with the girls. The fireman had another duty to perform, the neglect of which cost some of them their lives. All covered bridges were too low for the stacks; in consequence, the stacks all had a joint in them where the diamond and straight parts met. To handle the top of the stack, a long rod was connected to it, leading to the left side of the engine. On approaching a covered bridge, the fireman had to take hold of the rod and pull the stack down. It sometimes happened at night that he would not see the bridge in time, which, striking the stack, would knock it back, and drive the rod through the body of the fireman, if he happened to be on his box at the time; so you see it has been a dangerous calling ever since railroads were first worked by steam.

FIG. 2.

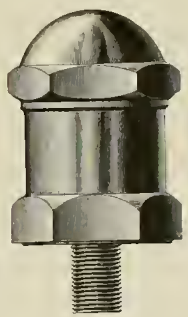


FIG. 1

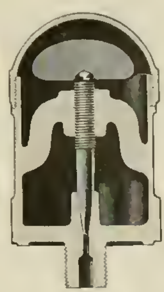


FIG. 3.

The Northern Pacific Oil Cup.

James McNaughton and Adam Beardsley, two mechanics employed by the N. P., several years ago invented the oil cups here shown, and they have since been through the test of time on that road, and have been adopted as standard. Fig. 1 is a rod cup; the top screws on, or it can be made to slip on and hold by a spring catch. Fig. 2 is a guide oiler; its cover slips over the entire cup down to the hex. for wrench. Fig. 3 is a sectional view of both cups.

As will be seen, the needle feeder is held in any position by the thread in the bridge; this bridge is cast in two pieces, and these halves are wedged apart while the thread is tapped, the wedge is then withdrawn, and the spring of the bridge binds the screw.

The feed can be adjusted by the thumb piece on top, and there are graduation marks on the cup top to regulate by, no wrench or screw-driver being necessary.

A large size of this cup is also made for engine trucks, and used on the N. P. The Reading road have also adopted this cup. Pedrick & Ayer, Philadelphia, are the makers.

A Substitute for the "Laying Off" System.

We are in receipt of a letter from a prominent railroad man, himself a brotherhood engineer, who has held many railroad positions of responsibility, saying that he has thought a good many times of some plan of punishment for breach of discipline and minor offenses, other than the common one of "laying off."

He says he knows of many instances where men have deliberately disobeyed orders and rules to get laid off when they could not get a rest by fair means, and is satisfied that in half the instances it is no real punishment unless of more than 30 days duration; he is, however, opposed to holding men off "pending investigation."

While the men would resist the fine system, it may have its advantages over the lay-off, yet we hardly see why. It would be better for the company, as it would not inconvenience them by running short of men, and for this reason would be liable to be used to excess, but whether it would be more punishment to make a man work for nothing, or not work at all, for a certain number of days, is an open question—we are inclined to think that either system is wrong and open to grave abuse, and the paying off of personal grudges.

Something beside mere reprimand is necessary for discipline, and we believe that the better way is to disgrace men by setting them back, take them off their regular runs, post a notice where all can see it that John Rogers, passenger engineer, worth $4 per day, did not answer signals given, and ran off an open switch, or had needlessly abused his fireman, and that he would run switch engine in the Agne Swamp yard for 30 days at $3.00. Or, Henry Smith, freight engineer, pay $4 40 per day, ran by red flag, causing collision; will fire freight engine 15 days, and then take his place as extra man on freight list.

This would be punishment and disgrace to men, and no one would seek to have his name on the list or go back to a subordinate position, and if he was obliged temporarily to do so, he would not be in idleness while doing penance, and his family would not be deprived of necessary support.

The Argentine Republic has a piece of straight track 211 miles long—the longest in the world. The *Railway Age* has been trying to find the longest tangent in the United States, and has settled on a stretch of track on the Carolina Central, between Marlville and Laurel Hill, North Carolina, which is 79¾ miles without a curve.

Correspondence

A Lubricator Idea from Newfoundland.

Editor The Locomotive Engineer:

In a recent issue of THE LOCOMOTIVE ENGINEER, I notice an item stating that Elijah McCoy had patented the idea of attaching lubricator's pipes to steam passages, etc., etc.

Now, during the past four years I have used lubricators on all the locomotives here in the same way, and they have given good satisfaction throughout.

ROB'T STEIN, M. M.

St. Johns, Newfoundland.

Master Mechanics Interested.

Editor The Locomotive Engineer:

Enclosed you will find order for a year's subscription, commencing with October issue. I was very much interested in your account of the Stourbridge Lion. I believe locomotive enginemen from top to bottom should read more. I have Colburn's and Sinclair's books on the locomotive, and think there is enough instruction there given to keep a man thinking for years.

I would advise all men in the business to have one or both, and in fact I now know of several who carry them in their seat boxes.

W. D. JACOBS, M. M.

San Pedro, Los Angeles & Utah R. R.

Pasadena, Cal.

That Balky Engine.

Editor The Locomotive Engineer:

I may be a little late, but in reply to Wm. R. Cline's conundrum in August number, I would guess that his "plug puller" had taken the key out of the throttle lever's connection to the stem, and that the other fellows were only moving the lever when they thought that they were moving the valve.

Denver, Col. H. D. DOYLE.

The Golden Rule.

Editor The Locomotive Engineer:

In your article on "Hasty Judgment" I found considerable food for thought, and hope the seed will not fall on entirely barren ground.

We have had several master mechanics here in my time, some engineers and some not, and I am free to say some of them have been grumbled to death by a few chronic kickers.

I think we ought to be at least fair, and not ask unreasonable things of men who are over us, but responsible to higher officers.

We have got an old engineer here as M. M. now, as fine a man as any body of men would wish to be under, but these grumblers and growlers keep nagging at him; instead of that, we ought to be proud to see an engineer our M. M., and do all we can for his success. He has been through the mill himself, and I don't believe he would ask us to do anything but what is upright and what he would do himself. I know, for my part, he has always been very obliging, and done his best to please us.

Hoping this will help rub in your advice a little, I am a believer in the Golden Rule.

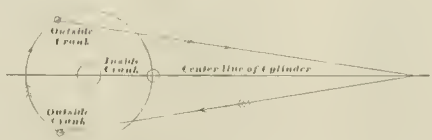
ENGINEER.

Montreal, Can.

A Triangle Engine.

Editor The Locomotive Engineer:

There are some signs of a change, or rather a necessity for a change, in locomotive construction, and I have been giving the subject considerable thought. Mr. Webb, of England, has built a number of compound locomotives, using three cylinders, and the idea struck me that the engine would be simpler and more effective using high-pressure steam in all three cylinders, and making the cylinders all the same size, and smaller than those now used. I would propose to place the cylinders in a row, and couple all three connecting rods to the main pair of drivers, and couple the back pair as usual with side rods.



I send you a plan of the cranks; the three cranks are equal distances apart, and are thus at *triangles* to each other, and not right angles.

The advantages I propose to gain by this scheme are steadier running, and you will see by the sketch that two cylinders are always at work, and the two cranks at work are more nearly opposite each other than in a quarter crank engine; by this plan the engine is in itself more nearly counter-balanced than ordinarily, and required to use less dead weight for this purpose, thus reducing the hammer-blow. Such a plan would make a more continuous application of power than the present plan of two engines coupled at right angles.

In place of the present 20 x 24 engine I should propose three cylinders of $16\frac{3}{8}$ bore. The three pistons, with their rods, crossheads, etc., could be much lighter than those now used, both because of the smaller cylinder and the self counter-balancing principles.

In Webb's compound engine it is possible to get the low-pressure and one high-pressure cylinder on the center—as the drivers are not coupled—in this case slack must be taken to start a train. In my triangle engine *two* cylinders are always in use, and no such center trouble could occur. Again, the compound engine jerks very hard when the big low-pressure cylinder takes steam—so much as to make the cars behind uncomfortable—a bad feature.

I shall not go into the details of construction or of cost; I make this show of my idea to have the mechanics of the country criticise it, and I want them to. I fancy with three smaller cylinders, a shorter cut off could be used than on two large ones; that they would wear longer, use less steam and thus less fuel; that they would apply their power more evenly around the axle, slip less, make the engine roll less, and ride easier.

We have had the celebrated Fontaine engine, the long cylinder, Roberts engine, the Strong engine, the flat-wheeled Swinerton, but we have not as yet had the *Triangle engine;* and if I do not present my humble idea, there would not be a chance for anyone to exclaim—what a fool idea!

H. KINGSLAND.

Fort Scott, Kansas.

[In 1853-54 there was a 3-cylinder locomotive built by the Phila., Wilmington & Balt. R'y. It was arranged with two sets of steam pipes, one to the outside cylinders and the other to the inside one. It was designed to start the train with the two outside cylinders and then keep it in motion with the center cylinder; she ran for several years. On the Gravity roads of Pennsylvania many of the hoisting engines are built with 3 cylinders, and when the Penna. Coal Co. started to build their road—now the Erie & Wyoming Valley—John B. Smith, now president, designed and built, at Dunsmore, Pa., about 1879, three locomotives arranged just as our correspondent has described, and possessing all the advantages he claims for them. While these engines give perfect and entire satisfaction, we notice that common, 2-cylinder locomotives have since been purchased by this company. While this style of locomotive has some advantages, it is yet—in first cost, maintenance, and liability to derangement—a locomotive and a half. Improvements in locomotives should tend to efficiency and simplification.]

Another Case.

Editor The Locomotive Engineer:

I see in the September number you have cut and description of Tripp patent piston valve. My object in writing you is that honor may be given where it is due. I have in my house a small engine that has been in good working order for over one year, that I made myself, that has the same valve; you could not tell them apart, only my relief valve is in four pieces; it has two end plates, which makes it very heavy. I can put this balance valve on any engine that has ports.

Greenville, Pa. J. P. SHAW.

[This invention seems to have been applied about the same time Tripp's valve was, but the inventor forfeited both the honor of the invention and the profits, by keeping still about it.—ED.]

Glycerine on your front windows will prevent them from retaining moisture and frost.

That Balky Engine.

Editor The Locomotive Engineer

I suppose some of the boys are wondering about that engine that wouldn't go; so here is the reason.

Her cylinder oil cups were tapped down on the sides of the boiler head, as you often see on different roads.

Some one had been fooling with the steam valve of oil cup in the absence of the engineer, and through ignorance or otherwise, of the meddler, it was left open. It was on the right side, and she stood some time without being moved; her cylinder cocks were shut, and of course in a few minutes the right cylinder was so full that she made a very sorry move indeed, it was strange the men could not find the trouble. A blind man could have located it when the cylinder cocks were opened.

Our night engineer wasn't the best in the world; hence the difficulty.

McArthur, O. WM. R. CLINE.

Some Roundhouse Pointers.—How To Grind Plug Cocks.

Editor The Locomotive Engineer

Chancing to be in a strange town, I strolled into the roundhouse of the only railroad in it, to see what I could learn, or steal, as we say. Well, I did not learn much, but I will tell you a secret. It would pay some railroad companies to subscribe for a few copies of THE LOCOMOTIVE ENGINEER and distribute them among their roundhouse men.

One gang of men were putting a new pair of wheels under the front truck of an engine; the journals, 5x7, were too large for the new brasses they were putting in, so they had planed a heavy cut off each side, so that the brass stood ¼" off the journal at each side. There was a strip of babbitt 1x6 on each side, but they were working that down to the circle of the journal. Between the strips of babbitt was a large recess for oil; the brass would not have more than ¼ the bearing of the surface of the brass, which was very rough. If they had cut a recess in the wood block they put in the brass to run the babbitt in ⅛ or ¼ deep, and as long as the brass, so as to leave the soft metal that much higher than the brass, all the fitting the brass would need would be to clean the sand well off it, and open the oil hole and put it in, pack the oil cotton good, with a little tallow on the top, so as to touch hard against the axle, the soft metal would fit itself, and the brass would come down slowly and no danger of heating. I have often cured a hot brass by putting a piece of sheet lead over the face of the brass, and turning the edges so it could not slip around.

Another thing I noticed which was radically wrong, and that was grinding brass cocks with emery. One man trying to grind a blow-off cock in the lathe with coarse emery, he would put on a lot of oil, then sprinkle it thick with emery, start the lathe and shove the body up on the plug and hold it for a few seconds; then renew the oil and emery; after awhile, when he cleaned it off, it was full of rings cut by the emery; he filed it off and did the same again. I think one copy of THE LOCOMOTIVE ENGINEER in that shop would pay well; I never saw a cock ground with emery

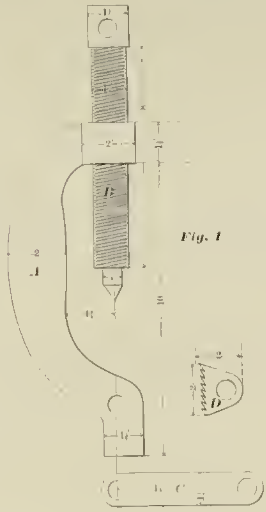


Fig. 1

Two of these links

that was worth anything. The emery will work into the brass, and commence cutting from the start. In re-grinding old work, they should be fitted first with a smooth file and a little oil, to show the high places when rubbed together. After they are well fitted, take some fine sand that is turned off the grindstone, and water, put the plug in the vise horizontally (not straight up), or the sand will work down and grind faster at the bottom than the top. In grinding, draw them apart at every turn, and they will not cut in rings. Gauge cocks often have a screw plug with the end turned to make the joint; these can only be ground by using a piece of brass without any thread on, that will go in and have the end turned the same taper as the plug. With this the seat can be ground, a slot sawed in the outer end for a screw-driver and a brace facilitates the work; then have a piece of brass with a hole in it the shape of the seat, to grind the plug with. All gauge cocks ought to have a loose plug with the stem running through the main plug, the end to come through the handle, so they can be ground without letting steam out, as the sediment and water will often answer for sand. A leaky whistle valve is a great annoyance, and the whistle is often screwed into the dome cap, and it takes ten horse-power to unscrew them; whereas if they were put on with a ground joint and three bolts, they could be easily taken off and reground; it is often these little things that could be so easily avoided, that make the worry and loss of time. An hour's thought may save a week's work.

J. J. BINGLEY.

Watertown, N. Y.

A Driving Spring Jack.

Editor The Locomotive Engineer

Having received much benefit from the "shop kinks" which I have often seen illustrated in your excellent paper, I would like to tell the boys of a handy back driving spring jack, which we find of great benefit to us in the roundhouse.

It is easily and cheaply made, and with its use we find it very easy to take out and put in back driving springs.

The enclosed rough sketch will enable you to form some idea of it, I think. *A* (Fig. 1) represents the body of jack, made of 1" x 1½" iron; the top end, through which the screw passes, we made 1½" thick, with 2" face.

The screw *B* (Fig. 1) we made of steel 1¼" x 8". These, with two steel straps *C C*, and a steel block *D* (Fig. 1), constitute the jack. The steel block *D* we fluted on the edge, which enables it to take a firm hold of the spring hanger. The fluted face of this block is 1" x 2". The two straps *C C* we made of spring steel ⅜" x 1¼", and pinned one each side of body *A* and block *D*, with ¾" x 2⅛" steel pins, allowing body and block to move freely between them. We put ⅛" spring cotters through the ends of these pins, as they can be more easily removed than nuts.

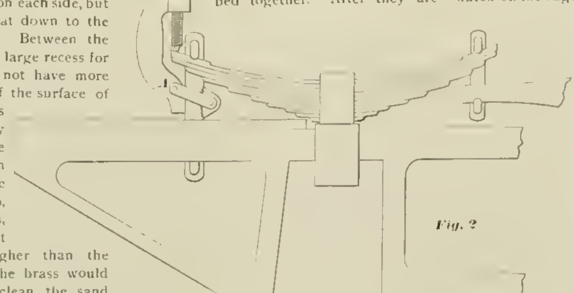


Fig. 2

To remove a spring with this jack, first raise the back end of equalizer as high as possible, and block it there. Then remove pin *A* (Fig. 2), leaving the other pin in place, pass a strap each side of spring hanger, *from the front*, and connect straps again to body *A*. When the hardened point of screw is applied to driving spring, the body *A* and block *D* are firmly clamped to spring hanger, holding it rigidly in place; at the same time the driving spring is compressed, rendering the removal of gib easy. As the screw is slacked off, after the removal of gib, the jack will roll on hanger at the point straps *C C* are connected to body *A*, and thus conform to upward and forward motion of the back end of driving spring, as the pressure is removed, thereby preventing the point of screw from slipping off the spring.

This "kink" is the idea of Mr. Seward Johnson, one of our roundhouse machinists, and has "helped us out" often when we have been in a hurry to change driving springs.

Hoping to see more of these "kinks" from the boys, I remain

L. C. HITCHCOCK,
Foreman Roundhouse.

Minneapolis, Minn.

Air Pump Repairs on the Providence and Worcester.

Editor The Locomotive Engineer:

I have been interested in the air pump articles in your paper, and thought perhaps our way of dealing with refractory pumps might help along the interest in that subject.

We came to the conclusion some time ago that it does not pay to tinker with air pumps on the engine. We keep spare pumps, which are always kept in order. When a pump is reported out of order or working bad it is immediately taken off and another put on. They being uniform, takes but little time to make the change, the engine is not delayed, and cuss words are unnecessary. When an air pump refuses to work there is something radically wrong with it, which the average engineer has not the necessary time or tools to fix. Sometimes the burnt oil and gum on the air valves can be made to work better by sucking in a little benzine or potash water. I have found the wings on some valves filled nearly full of this gum, thereby preventing proper work.

We take all pumps reported out of order all to pieces, give all parts a careful examination, and all parts fixed practically as good as new, carefully keeping the same proportions as in new pumps.

They are then tested in the shop—we have place fixed for that purpose. Every pump is tested to 75 lbs. air pressure, the pumps are started and stopped in all places and pressures, and thoroughly proved before they go out of the shop. A record is kept of the repairs on each, and the date when repaired; we know what each pump is doing.

The causes of stopping and improper work I find are many. The rings on small end of main steam valve broken—sometimes caused by the stop becoming short and allowing the ring to project below the end of cylinder—and ring springs out and prevents the valve going up, breaking the ring. Sometimes the stem on the reversing piston is broken. The reversing valve bushing sometimes needs grinding; frequently a new bushing is needed. Sometimes a bolt is found broken on the cap on main cylinder; when the reversing piston rod goes through, on the air end of pump, we find the valves badly hammered. The lift of the valves is out of proportion, and the air escapes freely. We use a reamer to true up the seats, put in new valves, and get the lift right. We frequently find the upper bush loose. This should always be examined and screwed up tight.

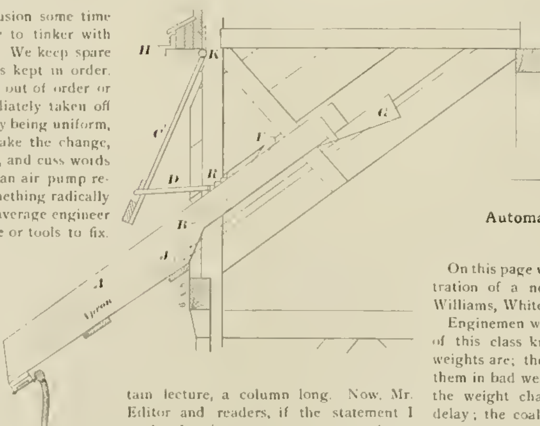
I think if these hints are followed out in air pump repairs, good results will follow. WILLIAM FOSTER.

Valley Falls, R. I.

The Long and Short Train.

Editor The Locomotive Engineer:

Judging from the manner in which J. E. Phelan came at me in the October number, he does not like any one to take exception to his writings. There I think him very inconsistent; for, after seeking to create a wrong impression of what I said, and remarking that "Life is too short to say anything further on the subject," he proceeds to deliver a curtain lecture, a column long. Now, Mr. Editor and readers, if the statement I made, that it was necessary to exhaust *more* air from a train of twenty cars than from one of five or ten, in order to reduce pressure a certain number of pounds, does not carry the idea that we take into consideration the number of cars in train in handling the automatic, I will retire and give J. E. Phelan a clear field.



He says, if we can "use *more* air without proportionate indicated reduction on air gauge, we would accomplish a novel feat."

Now I wish it borne in mind that in speaking of *more* air, I referred to twenty cars, as to five or ten.

If J. E. Phelan or any other man can reduce pressure in train pipe of twenty cars a certain number of pounds, without using *more* air than he would on a train of five or ten, he will do something outside of any known laws.

I am willing for anyone to make objections to what I say, but I don't like to have them misrepresent me.

He says he has seen a train of twenty-four cars where a reduction of five pounds did not set a brake, while eight pounds set them all. I will admit this, but go just a little farther, and ask one question: Couldn't the pressure have been reduced eight, ten or more pounds, without setting a single brake? I have seen pressure all taken from train pipe and not a brake set; but this is not saying it was done in a proper manner.

I have known engineers to start down a grade of 75 feet with a freight train equipped with air, and before going five miles to squeal for brakes. They had wasted all their air without setting a brake sufficient to do much good.

They probably handled it in a manner similar to the way it was done in the instance cited by Mr. Phelan, where a five-pound reduction wouldn't set a brake, while one of eight set all. It looks a little queer that a man couldn't get *one single brake to set* from a five-pound reduction, while with only three more he gets such good results.

For the benefit of Mr. Phelan, I will say that I have not graduated from an air brake school car, but have had a *little* experience in the use of the air brake. I am not an advocate of theory without practice. Better the practical man without any theory than *vice versa*; but I don't object to a little theory put into practice.

Denver, Col. H. S. H.

Automatic Coal Chute.

On this page will be found a detail illustration of a new coal chute, made by Williams, White & Co., Moline, Ill.

Enginemen who have used some chutes of this class know what a nuisance the weights are; the power required to move them in bad weather and the fouling of the weight chains that cause so much delay; the coal or drop door with independent latch is also a nuisance.

In this chute no weights are used, the apron being balanced and the drop door is held open automatically. By pulling on the rope the latch bolt is released from the hook *H* and the apron comes down easily, when nearly in position, arms on each side that extend back to the latches *B*, that hold the drop door *C*, on each side trip these catches and release the coal. This drop door is held open by the dog *D* dropping into the ratchet *R*. When the coal is all out the apron is given an upward push, and it returns automatically, tripping the latch *D*, and positively latching the drop door and itself. It is guaranteed that one man can always operate this chute.

Another advantage is that the trestle for cars is entirely independent of the chute building, and can be raised, lowered, repaired or removed without disturbing any timbers of the building.

This chute has been adopted on the U. P. and the C. K. & N., and each of these roads has put up over 200 pockets the past summer.

Honor to Whom Honor, Etc.

Editor The Locomotive Engineer:

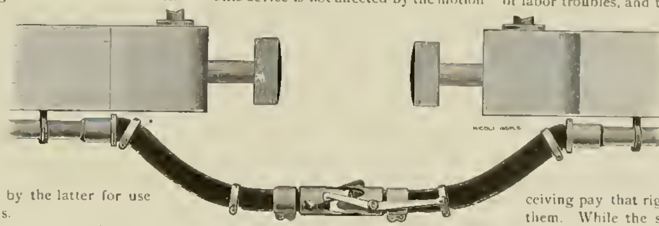
Referring to the article entitled, "Hard Tests of Chilled Wheels," in your issue for October, we beg leave to say that the honor of having invented the first contracting chill of which we have any knowledge is due to Mr. L. R. Faught, superintendent of our mechanical department. It was made in 1876.

"The Whitney Contracting Chill" was invented by the present senior member of this firm in 1885. A. WHITNEY & SONS.

Philadelphia, Pa.

Jacobs' Patent Steam Hose Coupling.

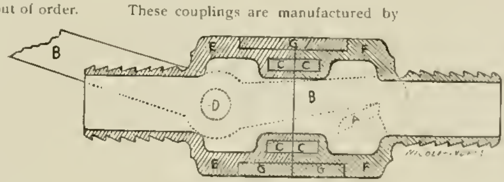
This coupling has heretofore been known as the Graydon coupling, having been successfully used by the Graydon Safety Car Heating Co., for one season, on the Vandalia R. R., and subsequently adopted by the latter for use on all their trains.



To meet the requirements for a first-class coupling for this purpose, the following conditions must be observed:

1st.—It should be constructed of few parts, all of which are strong and durable, and not liable to get out of order.

2d.—It must be easily and quickly coupled together without tools, when making up trains.

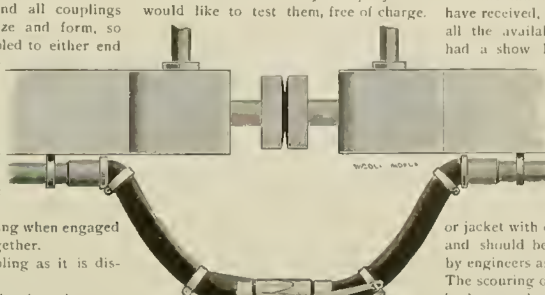


3d.—It should have a straight-through steam passage.

4th.—It must form a perfectly tight joint that will not leak.

5th.—It must disengage automatically when the cars are uncoupled and separated.

6th.—Both halves of the coupling must be exactly the same, and all couplings must be of standard size and form, so that any car can be coupled to either end of any other car and the steam couplings will match.



All of these requirements seem to be fully met by the coupling here illustrated, as will be seen on examination of the cuts.

Fig. 1 shows the coupling when engaged and the cars coupled together.

Fig. 2 shows the coupling as it is disengaging.

Fig. 3 is a section showing the construction of the device.

The coupling consists of two malleable iron castings, *E E* and *F F*, each of which has three projecting points, which overlap and project into corresponding recesses of the opposite casting. See Figs. 1 and 2.

Two levers "*B*"—one pivoted on *E E* and one on *F F*, as shown by "*D*." These levers are always on the left side of the casting to which they are attached. When the hose is coupled and depressed, as in Fig. 1, the hooks on the levers engage with the lugs "*A*," clamping the two parts of the coupling together by the combined weight of the hose and coupling, and holds them locked until the coupling is lifted or the hose straightened.

The two rubber packing rings "*C C*," "*C C*," made especially for this purpose, are of sufficient depth to insure elasticity, and made to fit the recess tightly. When the coupling is separated they project about ¼ inch. This packing has been frequently tested, and has proven all that could be required for holding steam or water.

This device is not affected by the motion of the cars or the swinging to the hose. It will hold perfectly tight until the cars are separated. There are no bolts, screws, springs or nuts to lose off, rust, or get out of order.

These couplings are manufactured by D. W. Williamson & Co., 482 E. New York st., Indianapolis, Ind., who will cheerfully furnish any further information that may be desired. A full set of these couplings will be furnished to any company that would like to test them, free of charge.

Heavy locomotives are very common nowadays. The Baldwin locomotives on the New Haven R. R. weigh 95 tons—passenger engines—and forty locomotives, weighing 157 tons each, are being built for the Canadian Pacific road, at Hochelaga, Canada.—*Engineer*.

As a matter of fact, the New Haven engines weigh about 110,000 pounds, 55 tons; on the Canadian engines Bro. Watson has probably got tons and thousand pounds mixed up. If he means tons he should have put it at even 200—if it don't make any difference to him—it is easier to remember.

Frank Eaton, an engineer on the Boston & Maine, has copyrighted a neat form of time book for engine and trainmen. It pays any man to keep his own time, whether required to by the rules of the company or not. Bro. Eaton's books cost but six cents each, or 50 cents per dozen—one might save you a trip's pay.

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* * * Railroad conductors have, as a rule, stood faithfully by the roads in time of labor troubles, and this society and the companies may be of material aid to each other.—*Railway Register*. This, it will be remembered, is the order that claims that the enginemen are now receiving pay that rightfully belongs to them. While the society is being of material aid to the companies the latter are introducing the ticket picker—claiming that the conductors are getting pay that belongs to the company. Queer world, this.

A. W. Wright, timekeeper M. C. R'y. shops at Detroit, sends us a club of 75 names, and modestly remarks:

"The paper is exceedingly interesting, and affords a great deal of valuable information to engineers and firemen. I will send another list soon after pay day. Am sorry to say there will not be many names, as I have only about 160 men on my pay roll altogether."

While this is not the largest club we have received, it is the best percentage of all the available men. If Mr. Wright had a show he would be at the head of the class.

The practice of cleaning the outside of an engine while running—unless it may be the hasty going over of bright work or jacket with oil in case of storm—is bad, and should be condemned and stopped by engineers as well as master mechanics. The scouring of cab brass while running is almost as bad. There have been several accidents of late because signals and switch lights on the left side of an engine were not observed.

Firemen already have many duties while the engine is running—especially soft-coal firemen—but every minute not otherwise necessarily employed should be used in watching the track and signals.

LOCOMOTIVE ENGINEER.
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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

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CONTENTS.

What We Ought To Do.

All over the country there are being organized railroad clubs, for the discussion of railroad questions. These clubs, as we understand it, admit any person employed by a railroad company, and are being encouraged and taken part in by many railway officials. The Brotherhoods are losing ground in this very particular, when they ought to be gaining, and we hope that the proposed federation of employes will be a federation of ideas and a coöperating educational feature.

The railroad labor organizations cannot hope to offer real, lasting inducements to railroads for the exclusive employment of their members, unless some feature is introduced that will say to the companies: "We can furnish you better posted, more temperate, and more experienced men than you can get outside; our lodge rooms are furnished with books, models of valve motions and brake devices that are in themselves educational and a safeguard; we hold regular meetings to discuss operative railroad topics, in which every member must take part—invaluable advantages that can be obtained in no other way."

Do we do this? Do we offer such inducements to railroad companies to employ us instead of outsiders? Do we have the books or the models? Do we hold the discussions? Do we attempt to offer better goods, or do we seek to monopolize the goods in the market, and restrict the output, compelling employers to use us or nothing? We ought to be employed; we ought to keep up our organizations; but at the same time we ought to make it a notorious fact that a member of any of our organizations enjoyed advantages that could not be had by any other man, or set of men.

The Death Roll.

During the past month one disaster has followed another so closely that scarcely a day has passed without its list of victims.

During the month of October there were between 100 and 125 lives lost on our railroads alone. At the Mud Run wreck on the L. V. road there were 67 persons killed, and all the other wrecks in the country show a list of about as many more.

One time it is caused by men working from 24 to 36 hours without rest, the next time the old stand-by, the "lap order," then the open switch, but the flagman that don't flag has done the most work.

While the public will take great interest in the Mud Run wreck, with its sixty-seven funerals, we want to remind them there are every month about one-half this number of railroad men butchered, and they scarcely get a two-line item in the news; indeed, a prominent New York paper recently referred to a wreck where the engineer and fireman jumped for life, after doing all they could to stop, in headlines like this, "Jumped, as usual!" "The engineer and fireman desert their posts, and leave the passengers to hurt and death!" After doing all they can to stop, our advice to men in the same fix, is to save their lives if possible—dead heroes are of little use to their families.

The laws need to look after the criminally careless flagman, the low bridge, the hand coupler, the steel trap frog, and the hand brake, on one truck only operated by the hand of a frozen brakeman from an icy deck, with a rickety wheel on a wobbly rod and a rusty chain.

If as many passengers were killed daily from the same causes as there are operatives, the whole country would be organized into a vigilance committee, and some of the death traps in daily use on dividend paying roads would walk the plank.

Take Honor When Honor is Due.

Railroad men should change the reading of the old adage, "Honor to whom honor is due," to the above.

Inventions are going on all the time, and old things are constantly being invented over by men who are, so far as they are themselves concerned, perfectly entitled to credit as inventors.

If Prof. Morse had invented the electric telegraph and kept his inventions a secret while he lived and buried them when he died, and we had waited till Edison's day for the Morse instrument at his hands, Edison would have been the inventor as fully or more fully than Morse.

Every year, yes, every month there are new kinks gotten up in every shop and road in the land, to cheapen the cost, or lighten the labor, or increase the safety of locomotives or their maintenance, and the inventor is called a bully boy by shop or road mates, or is thanked by the officers, and once in a great—a very great while—is rewarded, and he blushes modestly, and there is an end of it.

Six months or six years after it, he or some of his friends pick up a mechanical paper, and lo! and behold! here is the same thing invented, patented perhaps, and the inventor making money out of it; then the first inventor or his friends write the said mechanical paper, and head their letter "Honor to Whom Honor is Due."

Write before you see the same thing somewhere else, write when you get it up; if it has been invented before, you are an inventor just the same; if it has not been heard of before, take the credit, if not the profit, of your kinks and jigs; they are the offspring of your brain and skill, they are worth being proud of—be proud of them.

Last month we published a letter from a master mechanic in Texas, about the axle box planer tool shown up some time ago. The tool invented by his predecessor may not be anywhere like the one shown, and it may be almost identical—in either case the Texas inventor has lost not only the profits, but the honor of invention, by not taking an honor when it was due him.

This month we publish another letter from the master mechanic of the New-foundland Railway—the most northern on this continent—showing that the invention of a Michigan man in the placing of cylinder lubricators is six years old to him.

This paper is the medium of the "kink breeders" in locomotive practice; it costs nothing to show up and describe your tools and kinks if they have merit; the honor is due you; take it when it is due rather than claim it after another squatter has pre-empted the claim.

The Mud Run Disaster.

On October 10th, at the little flag station of Mud Run, Pa., on the Lehigh Valley Railway, occurred one of the worst wrecks of the year.

On that day there was a celebration of a temperance society at Hazelton, and excursions were run from several places on the Wyoming division.

In returning in the evening, the trains were ordered to keep ten minutes apart and the signal boards at telegraph stations were turned against each section until the last train was gone ten minutes.

At Mud Run the sixth section was stopped by the board, and the rear of the train was pulled by the station slightly; there were over 200 people on the train, mostly boys and young people; the rear lights were lit, and on the platform of the cars, but the board was not turned against the seventh section; a red lamp was set out on the depot platform for orders.

The seventh section was a double-header with air on rear engine only; there was a brakeman stationed on each engine to watch signals, and the flagman of the sixth section claims to have been out. Despite all this, the train crashed into the sixth section and killed 67 people and wounded many others.

We all know how young men and boys on a trip like this will get off the train at every opportunity, and it is very likely that they obscured the lights on the train and platform.

One thing is certain, the flagman was not back a safe distance, and failed to attract the attention of any of the six men on the locomotives; notwithstanding the order to go far enough and get on the train, he stopped instead of trying to gain his own train.

There is no doubt that the officers of the company made every provision they could think of for the safe running of the trains—perhaps they were too safe. If the telegraph stations had had no orders to keep the trains ten minutes apart the sixth section would not have stopped at Mud Run, and no doubt the big trains would have followed one another in safety. It is dangerous to change rules temporarily for any purpose.

The engineers testified that they were running about 12 miles per hour, and were not under control; would have been it running four miles per hour; this would seem to infer that the train had very poor air brakes.

The train was coming up hill and at 12 miles per hour should have been stopped in 200 feet easily, and in 4 miles per hour less than a car length.

The engine ahead had no air, and the second engineer claims to have been unable to see, on account of steam from front engine.

The following is the verdict of the coroner's jury in full:

"We find that the engineers of locomotives 452 and 466 of the seventh section were guilty of gross negligence.—First, in failing to discover the red signal in time, the evidence showing that this signal was in full view as their train approached; and secondly, for not approaching the station under full control as required by both the general and special orders. The evidence also shows that the air brakes of the entire seventh section were under the control of the engineer of locomotive 466, and that he could have stopped the train in spite of the locomotive ahead, No. 452.

"We find that the lookout men of locomotives 452 and 466 were guilty of gross negligence in failing to report to their respective engineers the red light at the station as the train approached. These men were placed on their respective engines as an additional precaution, their special duty being to look out for signals. The lookout man on 452 failed to see the signal. The other one on 466 testified that he saw it when about fifteen hundred feet from the station, and yet he reported all right to the engineer, and claims that he did not think the red light meant anything, as nobody used it.

"We find that the rear brakeman of the sixth section was guilty of gross negligence, for when his train stopped, instead of promptly going back the proper distance to warn the approaching train, he stopped at the station. There was time enough for him to have gone back nearly half a mile, but he went less than four hundred feet.

"We find that the conductors of the two sections failed in their duty, the first in not conforming to the rule requiring each conductor to see personally that his brakeman protects the rear of his train, and the second in not requiring his train to approach the station under control."

While the company will be held responsible, and have already set aside a large sum of money to pay damages, the law has reached out for the trainmen, and both engineers of section seven, the conductors of both trains, the lookouts on both engines and the flagman of section six have been arrested and charged with gross carelessness and willful misconduct—some accounts say manslaughter. It is very evident that there were several things that helped make the accident so fatal, and no one man is entirely to blame; but no practical railroad man can help seeing that inefficient flagging, or no flagging at all, was the prime mover in that awful butchery.

The article on Firing Anthracite Coal, on another page, is the first of a series on the same subject by a man who has put in ten years at it, and who is now a freight engineer on one of our Eastern roads.

"Vulcan" is well known to a large majority of mechanical readers, having contributed for years to several railroad papers, notably the *Fireman's Magazine*. Men who wear overalls are the best and most desirable correspondents of a paper devoted to the interests of and read by men who wear, or have worn over-clothes, grease, cinders, and anxiety, upon the locomotives and in the shops of our railways.

We are in receipt of a copy of Robert Grimshaw's latest book, "Preparing for Indication," published by The Practical Publishing Co., 21 Park row, New York.

The work consists of plain instructions, profusely illustrated, how to attach an indicator to any class of steam engine, how and where to pipe, etc. It is a small book, intended to prevent practical men from having to study and experiment in a field that the author has been over a good many times. The price is one dollar.

The Illinois Railroad Record, Vol. 1, No. 1, is before us. It is a 32-page monthly, under the management of C. P. Dresser.

The first number contains the annual report of the Railroad and Warehouse Commissioners of the State. The publication office is Springfield, Ill.

ASKED & ANSWERED

(62) History, Pittsburgh, Pa., asks:

Who invented the common cast-iron steam pipe? A friend says they were first used in England, but I have always understood that they still use copper pipes. *A.*—Wm. Mason, of Taunton, Mass., was the first to use cast-iron steam pipes. This was in 1853. They are not used in Europe to any extent.

(63) S. E. M., Plainfield, Pa., asks:

Why is the locomotive reverse lever so much harder to operate backward than forward? *A.*—If the counterbalance spring is properly adjusted, the lever will handle equally well either way when the engine is standing; in motion, the slip of the block will cause the lever to pull in the direction the engine is running.

(64) West Oakland, Cal., writes:

Has a locomotive with the ordinary link motion more lead hooked up than when down in the corner? "A," who is an engineer, says it has, but "B," who is a machinist, and worked on valve setting, says it has not as much—giving as a reason, that whatever lead an engine has, it will have at full stroke, forward or back, and as the lever is brought towards the center of the quadrant, the port opening will decrease, and therefore the lead decreases; but as I have always understood that an engine had more lead at six or eight inches than when working full stroke, I am at a loss to determine which is right. *A.*—The lead increases as you hook the lever nearer the center. Consult any work on locomotives or link motion.

(65) W. R. C., Ohio, writes:

A short time since, I was running a large eight-wheeled engine, Rogers' build. In the shop one day, I was filing main rod brasses, and discovered that the left main rod was bent down in the center, a strong half inch. I had been working her very hard the preceding day in getting over the hills with a heavy train. I had a wet rail, and had to use sand pretty often. The only thing that could have caused the bend, I think, was that she did it in catching herself on the sand, as I had to put a man out on the sand-box to feed it out, as my supply was limited when the rain began, and would not run only when he scraped it out. I could not catch her, without some danger. Do you think this caused the bend? *A.*—No. The main rod could only receive the pressure of the steam on piston, and must have been bent in some other way.

(66) N. W., Baraboo, Wis., writes:

A locomotive having eccentrics of 5 in. throw, breaking one, could a 4 in. throw eccentric be used in place of the broken one, and have engine square in all points of cut off, no change being made in valve gear but that of changing a 5 in. for a 4 in. throw eccentric and its position on shaft? Have heard of its being done, but cannot see how to get a 5 in. throw from a 4 in. throw eccentric. Rocker arms are of equal length. This is a question there is a great deal of difference of opinion among a few of us engineers, and if you will answer in your paper, you will confer a favor on us all. *A.*—By using the 4 inch eccentric, that side would cut off the same at each end of the stroke and be square; but the exhaust would not occur at same point as the other side, and would be called out of square—judging by the stack. The 4 inch eccentric would have to be advanced on the shaft slightly, to give proper lead.

(67) T. H. E., Nashville, Tenn., writes:

I am familiar with the rule for setting a slipped eccentric by placing engine on center and marking the stem by using the eccentric that is not slipped, for a guide, but what I want, is a rule to set a slipped eccentric without another to go by, suppose I slip both eccentrics on the right side, what am I to do, and why should I do it? *A.*—If both eccentrics on a side slip stop at once, protect your train, and be sure the eccentrics are slipped, before you go to work on them; if they are "off" beyond a doubt, take off the chest cover and pinch the engine onto the center (no matter which center), take the eccentric next the box first, as you can get the other out of the way to work at it; if this is the go-ahead eccentric, place the reverse lever in forward notch and turn the eccentric around on the shaft *ahead* until the port opens $\frac{1}{16}$ or $\frac{1}{8}$", the amount of lead you want, and fasten it there; put the reverse lever in the back notch and turn the back-up eccentric *back* until the port is open, the same as it was with the go-ahead, and fasten eccentric. Where only one eccentric is slipped, it is best to set it by marking the stem; that plan is the quickest, as you do not have to take off the cover. You will readily see that when one side is on the center, the engine will go either way, as steam is admitted to one side or the other of the piston on the other side of locomotive, as it is in the center of cylinder, and by setting the eccentrics to give lead on the center, and by turning them the right way, you can't get them wrong. A good engineer will always save himself all this trouble and delay on the road by marking the eccentrics in their proper position, if he is running a locomotive without eccentric keys.

In the Roundhouse and Repair Shop.

The elevated roads of New York carried over 183,000,000 passengers last year.

* * *

The Siamese government has granted concessions for building two lines of railways within the realm.

* * *

Owing to delay in getting out new patterns, we are not able to show Smith's exhaust nozzle in this issue

* * *

A recently returned Penna. R'y official is credited with saying that European roads employ six men to America's one.

* * *

At the shops of the New York City & Northern R'y, at High Bridge, they are putting in the Vreeland transfer jack, illustrated in the January issue of this paper.

* * *

The "Soo" road—Minneapolis, St. Paul & Sault Ste. Marie R'y, have adopted the Wescott, Bristol & Hinsey automatic brake appliance shown up in these columns in issue of Feb. last.

* * *

Ye editor has a nice steel rule and a leather case in his hip pocket, with the compliments of the *Iron Trades Review*, Cleveland, O. We are going to stop guessing at things now, and measure.

* * *

The Taunton Locomotive Manufacturing Co., of Taunton, Mass., are showing signs of new life. Mr. Wm. R. Billings has succeeded as agent and treasurer. New tools are taking the place of old ones, and better work and more work are the sure results.

* * *

Railway Life, Toronto, Ont., comes out for October with a new dress and a new editor, Mr. A. C. Campbell. The tone of the paper has been improved, and a series of articles promised from prominent Canadian mechanics that will be of interest.

* * *

Almost every other means but actual force has been exhausted to make rear brakemen go back far enough, and be sure they are seen, to protect their trains. There is not one road in the country where it is not shown every week that men are too lazy, or indifferent of the consequences, to do their duty. On all passenger trains the rear flagman should have no other duty, and fatal disasters caused by his neglect should place him behind a prison wall. These are severe measures, but severe measures are needed and invited.

* * *

Light locomotives are coming into use in a thousand places where it was thought they could never be used. They are now used in lumber regions to log, about mines and iron works, on large farms and plantations, on docks, in warehouses, on street cars, in coal yards, in lumber yards, over coke ovens, in brick yards, and in and around sugar refineries, etc. There are over 500 locomotives in the logging and lumber trades alone. There are many firms and corporations scheming to use locomotives where animals are now used, and this trade is one that is on the increase.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. I. NO. XII. | NEW YORK, DECEMBER, 1888. | $1.00 per Year. or 10c. a copy.

Smith's Triple Expansion Exhaust.

The exhaust stand here shown is the invention of John Y Smith, of Doylestown, Pa., the inventor of the exhausting device used on vacuum brakes, and it works on the same principle.

The stand can be used in short or extension fronts, and takes the place of the present nozzle stand and the petticoat pipe.

The passages marked *S* are exhaust steam passages, and it will be seen that there are three of them. Near the bottom of stand there is an opening through from front to back, and in its center a small exhaust nozzle, 1 inch in diameter; the blast of this nozzle draws in the hot gases from the front end, and, mingled with the steam, they are discharged through the central pipe *A*. As the gases in front ends are several hundred degrees hotter than the exhaust steam, they will superheat the exhaust, make it drier and hotter, and thus produce velocity.

The outside circle is also a steam nozzle, 9 inches outside diameter, and having an opening of 5/8 inch, or an area of 16 square inches; the second circular opening is for cinders and gases only, and has an opening of one inch, and is open at the bottom to the front end through the openings *A A*, all around the largest part of the stand; the third opening is 5 5/8 inches outside diameter, and has an opening at top of 3/8 inch, containing 6 square inches of area.

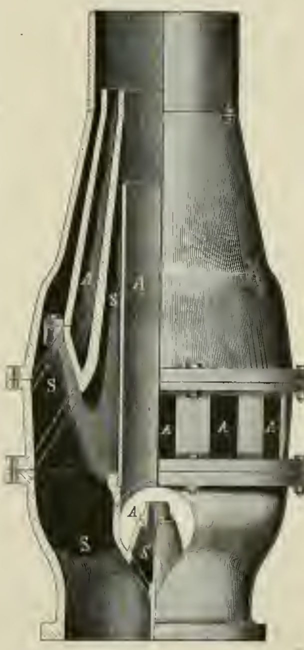
The combined area of the three openings of the exhaust are 23½ square inches, which would be equal to a single nozzle 5½ inches in diameter, or a pair of double nozzles, each 3⅞ inches in diameter.

Some of the beneficial results hoped for are: Reduction of back pressure to a minimum; prevention of ejection of sparks from smoke stack; almost complete absence of noise from exhaust, and keeping free and clean the flues and smoke arch.

Two of these stands have been in use for the past six months on the Boston & Maine, on engines with cylinders 16 x 24, and, we believe, are the largest nozzles in the country.

This road has ordered more of them, and several prominent roads have ordered trial pipes.

There is no doubt that there is merit as well as novelty in the plan, and from the success made of the exhausting instrument for vacuum brakes, we feel that it is in the right direction.



Smith's Triple Expansion Exhaust.

We know of a division of engineers who, a few years ago, were offered a valve motion model, by the master mechanic of the road where they were employed, and they refused to take it. The firemen got the model. Thomson's colt has always been considered the foolishest fool on earth, but for swell-headed ignorance that is glad of it, this beats all records.

STEAM PIPE REPAIRS.

The Experience and Practice of 150 Roundhouse Foremen.

Last month we asked for information about steam pipe repairs, and below will be found about half the replies we have received. Comments are made in another column.

HOUSTON & TEXAS CENTRAL.

About three years; time, about 8 to 10 hours; cost, including exhaust pipe joint, $4.60.
T. E. Kinney,
Hearne, Tex. R. H Foreman.

NEW BRUNSWICK.

About once a year; time, ¾ of a day; cost, $2.44.
Thos. Armstrong,
McAdam, N. B. Gen'l Foreman.

NORTHERN PACIFIC.

Have had but one case in three years; time taken ordinarily, a day of ten hours; cost, about $2.
S. L. Bean,
Fargo, D. T. Div. M M.

BALTIMORE & OHIO.

When bed-plate keeps tight on smoke-box, do not have to grind pipes, except when engine goes in for general overhauling; extension fronts seem to be a little the hardest on joints; to take down, grind and replace, costs about $3.
Zach. T. Braulner,
Highlandtown, Md. Gen'l Foreman.

CHICAGO, ST. PAUL & KANSAS CITY.

Only when in for repairs; time from 4 to 10 hours, sometimes longer; the cost, of course, depending on time.
C. J. Quimby,
Chicago, Ill. R. H. Foreman.

WISCONSIN CENTRAL

As a rule our engines run without steam pipe work, from one rebuilding to another, but the work is sometimes done. Scrape the joints first, then grind from 8 to 10 hours. Our machinist gets $2.50 per day.
Wm. Smith,
Chicago, Ill. Asst. Supt., M. P. & M.

EAST TENNESSEE, VIRGINIA & GEORGIA.

Ninety per cent. of our engines go from one overhauling to another without steam pipe work. Usual time, 18 hours, cost, $5.
A. T. Hooker,
Chattanooga, Tenn. Gen'l Foreman.

N. Y. CENTRAL & HUDSON RIVER.

Only when leak, seldom; work done by boiler maker and helper in about one day; cost, $3.75.
J. D. AVERY,
West Albany, N. Y. R. H. Foreman.

NORFOLK & WESTERN.

They run from 12 to 15 months; time, about ten hours; cost, $2.
JOHN A. HUMPHRIES,
Roanoke, Va. R. H. Foreman.

Only when overhauled. Machinist and helper will be ten hours at it. Cost, about $3.00.
ROBT. OWENS,
Crewe, Va. R. H. Foreman.

ILLINOIS CENTRAL, C. & D. DIV.

No oftener than we renew flues, or other work requiring removal of pipes; average time, ten hours; cost depends on condition; $2 to $3.
J. H. POLLARD,
Cherokee, Ia. R. H. Foreman.

RICHMOND & DANVILLE.

Have very little trouble; usually takes ten hours; costs $2.25; this includes removing and replacing, but not labor of putting netting and other appliances back.
GEO. W. O'BRIEN,
Atlanta, Ga. Gen'l Foreman.

MISSOURI PACIFIC.

Grind once in about two and a half years; time, eight hours; cost, $3.60.
EDWARD SLATER,
Lincoln, Neb. R. H. Foreman.

GRAND TRUNK.

Scarcely ever have this work to do, except when pipes are removed for flue work. It usually takes a fitter and helper two days to grind and replace.
Palmerston, Ont. THOS. MCHATHE.

DENVER & RIO GRANDE WESTERN.

About once in a year; time and cost depend entirely on how badly they are leaking.
F. W. VOLL,
R. H. Foreman.
Pleasant Valley Junc., Utah.

SHENANDOAH VALLEY.

Average run, eight months; not including T head; ten hours from time boiler maker commences to remove front casting, till engine is ready to fire up. We use a cement composed of twenty-five parts clean, sifted, cast-iron borings, two parts whiting, one part sal-ammoniac, dampened with water; we calk this between top of saddle and bottom of extension, to prevent front from getting air. Cost, $3.75 for entire job.
J. G. MASK,
Hagerstown, Md. R. H. Foreman.

CAIRO, VINCENNES & CHICAGO.

Unless some accident happens, only when they go in shop. Time, eight to ten hours. Usually $2.00 to $2.50.
W. F. GIBSON,
Cairo, Ill. R. H. Foreman.

MILWAUKEE, WEST SHORE & WESTERN.

Never, except engine is in shop for general repairs; time there about sixteen hours. Cost, $2.56.

I have been connected with this company for nearly six years as foreman, and have never seen but two engines on which the steam pipes started to leak after the engines were put in service, and this was caused by the cylinder saddle becoming loose on the smoke arch.
F. SLATER,
So. Kaukauna, Wis. Gen'l Foreman.

K. C. S. & C.

From twelve to fifteen months; time, one man about two days. Cost, $5.00.
W. S. KNAPP,
Olathe, Kas. R. H. Foreman.

BURLINGTON & MISSOURI RIVER.

Have only ground one set in two years; as near as I can figure, cost about $5.
J. C. KENNEDY,
Red Cloud, Neb. R. H. Foreman.

CUMBERLAND & PENNSYLVANIA.

All our engines are extension fronts, and run from six weeks to six months; time, ten to fifteen hours. Piece-work, and costs about $2.25.
W. H. SCHUTS,
Wellsville, O. R. H. Foreman.

CINCINNATI SOUTHEASTERN.

Once in two years; time, about twelve hours; cost, about $4.00.
J. C. KISER,
Somerset, Ky. R. H. Foreman.

CINCINNATI, NEW ORLEANS & TEXAS PACIFIC.

About every two years have taken out, gound, replaced, and had engine ready for train in thirteen hours. Cost, $1.00 per joint.
C. E. WALKER,
Ludlow, Ky. R. H. Foreman.

When engine is overhauled, or about once in two years; time, one day; cost, machinist and helper, $4.00.
THOS. WALSH,
Somerset, Ky. Div. M. M.

CHICAGO & INDIANA COAL.

Once a month; time, about four hours; cost, $2.00.
A. RUNYON,
Lacrosse, Ind. R. H. Foreman.

CINCINNATI, SANDUSKY & CLEVELAND.

Only when in shops for repairs; time, eight to ten hours; cost, $3.50.
W. B. PORTER,
Springfield, O. R. H. Foreman.

WEST SHORE.

About once a year on engines making 256 miles per day; time required to take down, ground, and replace, fifteen hours; cost, about $6.00.
V. B. LANG,
New Durham, N. J. R. H. Foreman.

ATLANTIC & PACIFIC.

Will average about eight months on extensions. Time, machinist and two helpers, ten hours; cost, about $8.00.
PERRY J. BROWN,
Albuquerque, N. M. R. H. Foreman.

MILWAUKEE, LAKE SHORE & WESTERN.

When in shops; time, two days; cost, $6.00.
ED. MURPHY,
Ashland, Wis. R. H. Foreman.

BALTIMORE & OHIO.

I have recently resigned the position of foreman at B. & O. shops here, but we seldom did such work on engines in service. I would ask brother foremen if there is found any more trouble with steam pipes in engines where the fire-boxes of boilers are supported on the vibrating hangers, placed above the frames as in the Wooten and P. R. R. (Class P.) type of engines. It appears to me to be more with them than with the eight-wheel engine, where fire-box is between frames and secured by angle plates, clamps, and braces on back head.
W. A. BROWN.
Wilmington, Del.

OHIO, INDIANA & WESTERN.

When engine is shopped or has flues removed. Keep a cheap man for such work. Time, from 5 to 7 hours. Keep no itemized account of cost.
LOUIS PFAFFLIN,
Indianapolis, Ind. Gen'l Foreman.

WABASH R'Y.

We have no general repair shop at this point. I give the practice as near as I know on the road, as a whole. We have very little trouble with steam pipes, seldom taking them down until engines go in for flues or general repairs. With so many different classes of engines as we have, I find a great difference in time to do such work. Average, 18 months between grinds; time, 18 hours; cost, $4.50. Your paper gives good satisfaction, and is doing good work; hope to see all our boys take it next year. No trouble to pick up a kink in it, and you are sound on the Q. and Frank Smith questions.
FRANK C. ROBINSON,
Danville, Ill. Gen. Foreman.

Very seldom; have taken down both pipes and nigger-head, ground and replaced in 7½ hours, two men; cost depends on work; have ground set for $2.80.
J. H. MCCLURE,
Andrews, Ind. Gen. Foreman.

FLINT & PERE MARQUETTE.

Once in from 12 to 18 months; time, 10 to 12 hours; cost, $2.00; if rings have to be scraped, $3.00.
J. CHRISTOPHER,
E. Saginaw, Mich. R. H. Foreman.

KANSAS CITY, FORT SCOTT & GULF.

Once in 2 years; time, 12 hours. $5.00 will cover all expense.
ROB'T E. WHITE,
Fort Scott, Kan. R. H. Foreman.

NEWPORT NEWS & MISSISSIPPI VALLEY.

Grind when necessary. A machinist and helper will do job in from 8 to 10 hours. Cost, about $3.00.
J. R. PEARCE,
Memphis, Tenn. R. H. Foreman.

CHICAGO, MILWAUKEE & ST. PAUL.

In modern engines very seldom do steam pipe work; one man will grind the four joints in ten hours. We let the engine lose a trip on account of heat in extension front end. For short fronts $2, and for extensions $8, is a fair estimate of cost.
JOS. ADAMS,
Milwaukee, Wis. R. H. Foreman.

CHICAGO, ST. PAUL & KANSAS CITY.

Grind steam pipe joints about once in 18 months—when setting new flues. Time, about ten hours. Freight engines are hardest on pipes—hilly division. Total cost, about $5.
G. W. ROBB,
Des Moines, Ia. R. H. Foreman.

WRIGHTSVILLE & TENNILLE R'Y.

Our steam pipes require grinding only once in from eight to ten years—they are copper; it takes about one day. We use varnish on the joints. Our engines are of one class, 14x24, wood burners, short front ends; we require them to pull both passenger and freight trains. Our steam pipes are of copper, with cast-iron joints; we have a loose joint of brass between the T pipe and steam pipe, flat on one side and a ball on the other. When joint is defective, we face the loose joint up in a lathe, and file and scrape the others, preparatory to grinding. We have no special tools or special men to do such work. Our joints never give any trouble.
B. T. COLE,
Tennille, Ga. M. M.

ROME, WATERTOWN & OGDENSBURGH.

Usually takes from eight to ten hours; have cast or boiler iron covers over lower joints; time, one day for two men.
DAVID DRAKE,
Norwood, N. Y. R. H. Foreman.

DELAWARE, LACKAWANNA & WESTERN.

Not oftener than once in two years, when cylinders are properly fastened to arch and frame, only when engine is overhauled. Time depends entirely on how long it takes to get pipes out. Ordinarily one good man will do it in two days; cost $5.00.
W. B. DAY,
Port Morris, N. J. R. H. Foreman.

CHICAGO, ROCK ISLAND AND PACIFIC.

I have seventy-five engines, and don't grind six joints a year. Time required, a day or a day and a half; cost, $3.50 to $6.
E. W. KENYON,
Chicago, Ill. R. H. Foreman.

CENTRAL IOWA DIVISION,
C. R. I. & P.

Very seldom except when pipes come down for flue work. Time and cost depends on condition of joints.
C. S. BINKLEY,
Des Moines, Ia. R. H. Foreman.

Flues are re-set every three years; steam pipe work, seldom done at any other time; time, 10 hours; cost $5.
MOSES HOBBS,
Davenport, Ia. R. H. Foreman.

Scarcely ever, except when flues are removed; time, about three hours, unless very bad; cost, about $2. A. L. SWIFT,
R. H. Foreman.
Leavenworth, Kan.

MISSOURI PACIFIC.

Out of 52 engines grind about two sets a year. Time, five to fifteen hours; cost, from $1.37 to $4.25. CHAS. HAMMOND,
Sedalia, Mo. R. H. Foreman.

ST. AUGUSTINE & PALATKA.

Have had them run five years without grinding; never do the work in the roundhouse.
E. BALLARD,
R. H. Foreman.
St. Augustine, Fla.

PENNSYLVANIA R'Y.

Only when necessary to take out flues; time, about three days, with extensions; cost, from $3 to $9.
JNO. SEXTON,
So. Amboy, N. J. R. H. Foreman.

Very seldom do this work; the time taken, as well as the cost, depends entirely on how long it takes to get the pipes out.
WM. H. VANDEGRIFT,
Kensington Shops, Phila. R. H. Foreman.

As a rule, about once in 18 months; sometimes it takes from four to six days—depends on how badly they are worn; cost, from $16 to $20. J. W. MADDEN,
Columbia, Penna. R. H. Foreman.

If smoke-box is in good order, about once a year; time according to condition, say forty five minutes to an hour per joint; cost, hard to estimate, say from $1 to $2.
J. J. W.,
Cressona, Pa. Gen'l Foreman.

Only when engines are in for flues; time, from seven to ten hours for all joints; cost, from $1.75 to $2.
J. A. BEAMER,
Altoona, Pa. R. H. Foreman.

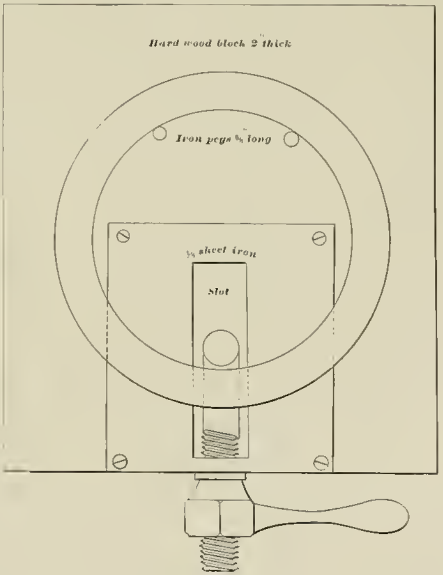
Only when flues are renewed, or they accidentally leak; time, for two men, fifteen hours; cost, $7.20. S. GARABRANT,
Jersey City, N. J. R. H. Foreman.

CANADIAN PACIFIC.

No trouble with joints; time depends on conditions; have done some in three hours, and on others it took fifteen; cost, of course, depends on condition, and what kind of men on job. M. COLLINS,
Brodview, N. W. T. R. H. Foreman.

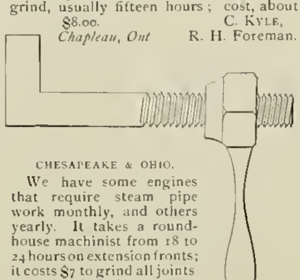
Seldom leak; have engines now running five years without a leak; average time, ten hours; cost, about $4.00.
S. PHIPPS,
Fort William, Ont. R. H. Foreman.

We seldom have trouble, except when cylinders get loose or other similar causes.



KYLE'S RING HOLDER

I send you a sketch of a block we use for holding the rings; any mechanic can see the design and use of the device. Time to grind, usually fifteen hours; cost, about $8.00. C. KYLE,
Chapleau, Ont. R. H. Foreman.



CHESAPEAKE & OHIO.

We have some engines that require steam pipe work monthly, and others yearly. It takes a roundhouse machinist from 18 to 24 hours on extension fronts; it costs $7 to grind all joints
J. T. MARLEN,
R. H. Foreman.
Newport News, Va.

RICHMOND & DANVILLE, V. M. DIV.

Only when overhauled; usually takes five hours to take down, grind and replace; costs about $2. JAS. W. SHINN,
Alexandria, Va. R. H. Foreman.

ATCHISON, TOPEKA & SANTA FE.

It takes machinist and helper ten hours; to grind alone; cost, $4 to $8, exclusive of taking down and replacing. I have lately resigned my position as foreman at Argentine, Kan., my successor being P. F. Baker. BEN JOHNSON.
Ithaca, N. Y.

About every five years; time, about ten hours; cost, grind and replace, about $6.
FRANK SINGER,
Pueblo, Col. Machinist.

Once in eight months on freight engines; time on extensions, 12 to 15 hours; short fronts, 10 to 12; cost, short fronts, $5; extensions, $7. H. GIEGALETT,
Raton, N. M. R. H. Foreman.

OHIO & MISSISSIPPI.

About once a year; time, from eight to ten hours; cost, about $3.80. A. J. ROSS,
Seymour, Ind. R. H. Foreman.

C., B. & Q.

Grind steam pipes only when engine gets a general overhauling; if they are not in bad shape, one man can grind the four joints in a day; costs about $2. G. J. CEMPESRY,
Rock Island, Ill. R. H. Foreman.

Since introduction of relief valves, very seldom; time, machinist and two helpers, about one day; cost, about $7.
GEO. L. BECKWITH,
Creston, Ia. R. H. Foreman.

CHICAGO & NORTHWESTERN.

About ten months; takes one man a day and a half. We use shields on lower joints in extension fronts; cost, $1.85 for short fronts. NOAH WARRINGTON,
R. H. Foreman.
Huron, Dak. T.

Every 15 months; time, about 16 hours; cost, $2.20.
FRED. W. COX,
Belvidere, Ill. R. H. Foreman.

Only when we take out to reset flues; time for steam pipes alone, half a day; cost, about $6.
J. W. CRYSTER,
Chicago, Ill. R. H. Foreman.

When engines go in for general repairs; time, from one to two days, depends on condition of joints; cost, from $3 to $4.
JOS. COCKFIELD,
Boone, Ia. R. H. Foreman

When they go in shop, as a rule; time, from two to five hours, depends on condition; cost, $3.85.
PETER MOTTERSHEAD,
Boone, Ia. R. H. Foreman.

When shopped for general repairs; we use a rose double bit; time, about five hours; cost, $1.25.
E. J. HAYWOOD,
Janesville, Wis. R. H. Foreman.

On the W. & St. P. Div., every 8 to 16 months, or when we put in flues; time to grind and replace, 10 to 20 hours; cost, $4 to $6. C. B. PECK,
Tracy, Minn. R. H. Foreman.

We have no rule as to time; have to grind in considerable; time, one to two days; cost, $3 to $4. GEO. ALLEN,
Des Moines, Ia. R. H. Foreman.

A Blow-Back Kink.

On some of the P. & N Y engines we notice a large 3-way cock in pipe to Ashton, blow-back safety valve, so that the fireman can send the steam to the stack to act as a blower, or to the tank. As far as our experience goes, when the water is low in the tank, and the boiler hot enough to pop, it is not only annoying, but absolutely dangerous to blow steam into the tank, especially where injectors are used.

What the blow-back wants is a valve that will make it blow into the atmosphere, except when a man holds it open to the tank.

A Pennsylvania Railway Shop.

The tramp editor started out last month to find something new, and the results of his observations are recorded below

A CHANCE TO EAT.

Having heard much about the Pennsylvania shops at Renovo, we headed for there and the first thing we hit, out of the usual run of things, was breakfast at Williamsport—not but that we eat regular—but when we got into the dining room the tables were all set; meat, potatoes, eggs, coffee, and all steaming hot and ready to be eaten, and the agile waiter stood behind the guest and replaced hot cakes as fast as they were worn out; by this arrangement 20 minutes is long enough to eat. A railroad man that is used to the old catch-as-catch-can plan, is liable to founder himself.

RENOVO SHOPS

At Renovo we found large, well-kept shops, built around a square, and everything, from the smoke-stack to the scrap heap, was clean.

Most of these shops were built in 1860, but they differ very little from those built last year.

Wm L Holman is master mechanic here, and has been for some years, having been with the Pennsylvania R'y over 20 years.

CLEANLINESS PREVENTS DIRT.

The square between the shops has wide cinder roadways, running in every direction, through grass plots and flower beds. The cinders are as level and clean as if just swept. When Mr. Holman came to the shops this square was the scrap heap and dump yard for all the shops, and any employe who had any dirt to get rid of went there with it, and men were kept constantly at work cleaning up. He had it thoroughly cleaned, and gave notice that no dirt must be thrown there; and now once a month is often enough to clean—because it is not dirtied.

FIRE APPARATUS.

Near the center of the square there is a neat engine house, and a new Le France fire engine stands within, in all the glory of nickel plate. Live steam is supplied to the boiler by connection to the stationary boilers, and the fire-box is all charged for a quick fire, an engineer is in charge of the fire apparatus, and the men are trained for fire duty.

USEFUL OLD FIRE ENGINE.

An old-style fire engine, discarded, has been rebuilt and is used to send away to pump at water tanks, while other pumps or boilers are repaired, to pump out cellars, bridge foundations, or any similar work.

THE PIECE-WORK SYSTEM

Everything at these shops is done by the piece; there are 700 mechanics employed and they are at work for themselves. Every bit of work has a price for it, and is duly recorded in books in each department and in the office It is worth so much to ream and fit a bolt, and if you have to go to the storehouse or blacksmith shop for it, it is so much more; if a car carpenter bores a hole in an end sill he knows he has earned so much, and the laborer who carries the piece to the saw or planer gets so much per stick—some of these jobs are figured down to 1-7 of a cent.

The erection and dismantling of engines is done in the same way.

THE SYSTEM OF INSPECTION

is much like that at Baldwin's; each man inspects the work of those ahead of him; if one man accepts a piece of planer work to do turning on, and finds, when done, that the planer man made a mistake, it is his funeral, not the planer man's; he must measure the piece by the drawing and know that it will finish, before he puts work upon it These shops build quite a number of engines every year in addition to their work of maintenance.

MACHINE SHOP.

The machine shop is large and well lighted—there are electric lights throughout the shops—and the machines are about as seen in any shop, except that there is not enough for the work in hand. The General Foreman, Chas. H. Potts, is a young man less than 30 years of age, who learned his trade in the shop, and seems to know the place and the work, from the ground up. The air pump repairs and the polishing of bright work is done upstairs and the heavy grinding in the cellar. The shops are wide, and the pits are on one side and the machine tools on the other—which seems to be a better plan than the usual one with the tools in one end of a long shop and the pits in the other.

THE TOOL ROOM

occupies one corner of the machine shop, and is divided from it by a wire screen. Complete sets of gauges are there carefully kept in cases, together with the thousand and one templates and distance pieces found in a shop building everything to as close a standard as the P. R'y demand. Here we saw a very simple, yet ingenious machine, for making flat split keys for car work. Commercial keys of this class cost from 10 to 12 cents per pound, the iron costs 4; by attaching an arm of this machine to the back of a shaping machine bar a boy will make a barrel full of keys a day, costing less than half the price of commercial keys. Milling cutters are used for many purposes, and all keyways are cut with them, to avoid sharp corners—we were shown several old driving axles that broke, always starting at the keyway

THE BLACKSMITH SHOP

is one of the largest, busiest, and best arranged we ever saw, and is under the care of John Green a most ingenious mechanic. There are several steam hammers of different sizes, punches, shears, and heating furnaces. There is hardly a piece of forging for locomotives or cars that he has not a die or former for—indeed, these devices occupy a large plot of ground outside the shop. His special tool for forming the standard wrought-iron draw-head for freight cars under the steam hammer, without a single weld, is a most ingenious thing. It was found that a loss of time and fuel was sustained when the heating furnaces were allowed to cool off at night so they are kept hot, and to keep the heat from going to waste, a blacksmith, heater and hammer boy will work at night on some work that is principally heating and forming under the hammer, thus keeping up stock and doing work that is in the way of the workmen in the day-time.

THE FOUNDRY

is not extra large, but is cleanly, light, and turns out good work, and lots of it. It is under the foremanship of Wm. H. Nichols, and every item of work done there is paid for by the piece.

THE CAR SHOPS

are quite extensive, well fitted with machinery, have a steam transfer table, etc.; they are under the foremanship of R. M. Messimer.

THE ROUNDHOUSE

is in charge of Jos. Spencer; is large and well kept, but, like all other roundhouses where there are shops, there is little work done there; one novel feature is a man on the turntable who oils every tank truck box that crosses it. The engines run first in first out, and are kept going, no one having a regular engine. Here, as everywhere else on the Penna. system, the master mechanic has nothing to do with the engineers and firemen—they are under the superintendent—the motive power department simply furnishes them engines to run; the

ENGINEERS

have no work to do; they have no regular engines, and when they come in they simply report anything that is wrong. Of course, with such a system there must be a connecting link between the transportation and the motive power department, and this is found in the

TRAVELING ENGINEERS.

These men are selected from the cream of the engineers, and hold responsible and important positions; they are not, as a rule, men who think injectors are a mystery, or that it is unlucky to start an air pump on Friday. John W. Sheldon holds this position here, and the men say he is so square he has got corners on him.

WAGES.

Mr. Holman became satisfied years ago that some mechanics were worth $5 per day and some 50 cents, the way he was paying them, and concluded to pay for what they did, and his plan of piece work is the result of years of study and experiment He figured to let men make 35 cents by the piece where they would get 30 cents by the day, and this is the average rule. Average pay of machinists is from 30 to 35 cents per hour, and in busy times they make from $100 to $120 per month. All the men with whom we talked said they made more money than they could by the day, and liked the system, and the fact that so many of them stay for years is proof of their preference.

APPRENTICES

are required to work 3100 hours for a year, and are paid by the hour when not on piece-work. Most of the men learned their trade in the shop; they very seldom hire or discharge a man.

THE SYSTEM

has its advantages and disadvantages, but, so far as we are able to see, it is better for the men, cheaper for the company, and prevents loafers from getting the gout by reading novels and smoking in the unwholesome closets.

The Dickson Locomotive Works.

These works, at Scranton, Pa., are reasonably busy on an order of twenty-eight engines for the Georgia Central, two for the K P., four for the D & H C. Co., and one for the Normandale Lumber Co.

The Georgia Central engines are built to the designs of Mr Blackwell, the Supt. of M. P., and are very handsome machines. He uses solid-ended side rods of I section, and the back end of main rods are of the fork, or open-end design, so much used on the Penna. He also uses an improved form of Laird guide, with a lower bar of wrought-iron, and the top one very wide and heavy, of cast-iron. The works are building many engines with this form of guide.

This firm have made a needed improvement in their designs, that could well be followed by others; instead of using two studs at lower joint of steam pipes, they use four bolts, and they are held to cylinder saddle by heads let into T slots; this makes a sure joint, and the bolts are easy to get in and out; studs burn, break, and have to be drilled.

In the machine shop there is a room devoted to small work, mostly drill presses and bolt cutters. As all the "cubs" land here when they start to learn the trade, it has got the name of Castle Garden.

The drawing room is the best kept place about the works, and the card system of drawings for shop work is here carried out very successfully; no scale is used, but every piece of work is drawn on a certain sized card as large as it can be made, and all the sizes are marked on; these cards are coated with three coats of shellac and washed after every trip to shops, and some of them are plain and clean after twelve years of service. A general plan of all engines built is drawn on a scale of two inches to the foot, and filed for future use. These works furnish repairs of all kinds, boiler frames, cylinders, etc., or do rebuilding for others.

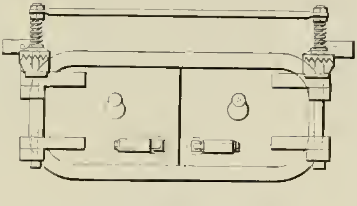
Outside the shops we noticed the Hawley screw snow plow, that they built some two or three years ago, and an old-time consolidation engine built at the Baltimore Locomotive works many years ago. There was no date on the relic, but some genius had chalked on the cylinder "1936 B. C." About the handsomest and cleanest little engines in the country are the watch charms built by this firm for the N. Y and Brooklyn bridge.

A New Fire Door.

The fire door here shown was designed by Chas. Graham, M. M. of the D. L. & W Ry. at Scranton, Pa., and is intended for culm or dirt-burning engines with a very wide fire-box, and is double the size of the ordinary door—a much handier and neater design than two independent doors.

The doors work entirely independent of each other, and are provided with wooden handles—a humane kink that firemen will appreciate.

In the center of each door is a "peep-hole" to watch hard coal fires; but the best part of the arrangement is the device to make them stay where you put them. This consists of two loose blocks of iron with ratchet faces, that are more or less



tightly pressed together by a spring above them.

The lower block is cast to fit over the hinge casting, and must turn with the door; the upper one has a wing that abuts against the boiler, and is thus prevented from turning. The rod across the top is merely to brace the spring rods

The fireman can keep the spring just tight enough to prevent the ratchet from slipping, and the door will stay in any position without any other latch. The device could be applied to single doors as well as double. It is not patented.

Manual Training Schools.

The American people, or, more properly speaking, the American press, are very much given to over-estimating the results of every new, good thing If a man invents an electric motor that propels a street car, the reporter or the editor see only the street car in motion, and they at once write glaring head-lines for glowing editorials, stating that "Locomotives are Doomed," "The Last Steam Boiler Built," "The New Power," etc., etc. It is the mechanic who goes behind the scenes and finds the big steam engine that furnishes the "current," which in this case is only a belt.

The latest chance for over-doing and promising unreasonable things for a reasonable and rational improvement is the Manual Training School.

The daily papers of this city have repeatedly represented that a professor was teaching boys to be carpenters by a few lessons with bench tools, and mechanical engineers and draftsmen were being made offhand out of whole cloth.

The manual training school is a grand, good thing; it mixes up a little practice and a little theory and gives them out to those able to receive them. They tend to lay the foundation for practical mechanics who are well grounded in the theory and history of mechanics, and of draftsmen and designers who know a meat-axe from a buzz-saw.

One of the most successful schools of this kind is the Spring Garden Institute, opposite the Baldwin Locomotive Works, Philadelphia. This school was originally founded by officers in these works to aid their apprentice boys to a better education and greater usefulness. They depended on the shop to teach the trade and the evening school to teach the theory and drawing; outsiders sought admission, and practical shop operations were taught them by supplying tools and giving them examples with the shop boys. The duller students made good mechanics, the brighter are draftsmen either in the Baldwin Works or other works in the city.

Mr. Crawford, chief inspector at the Baldwin Works, has taken a deep interest in the work, and informs us that all the young men who go through the course are engaged ahead to take positions of responsibility.

Manual training schools do not manufacture mechanics or mechanical engineers, but they do help apprentices to become well-grounded, able mechanics, and they do help draftsmen and designers to become familiar with mechanical operations.

Last month his duties as general road foreman of engines of the entire Northern Pacific system, bore so heavily on the hands of our contributor, J. E. Phelan, that he skipped his regular air brake article. He resumes the subject in this issue, which we hope will be considered an answer to the many inquiries we have had on the subject

Some of the D. L. & W. culm burners have a water column in the cab, such as is used on stationary boilers set in brick work. We do not like the idea, and see no reason why the gauge cocks and water glass should not be tapped directly into the boiler—the water column is only another connection to be broken off in case of accident.

On some L. V. engines with a crooked draw bar between engine and tank, General Foreman Ross, at the Wilkesbarre shops, has made a needed improvement. He puts an extension plate below the tail piece of the engine, and couples between the lower piece and the extension. This allows the use of a straight bar, makes the engines ride better, and saves work on the connection.

Correspondence

Pull of Reverse Lever.

Editor The Locomotive Engineer.

In your November issue you tell S. E. M (Question 63) that the reason the reverse lever pulls in the direction the engine is running is because of the slip of the block. Now, while this is the universal reason given, and is taught in locomotive books, it is not right. The angle of the link is changed from front to back in running, and if it was the block, it would tend to lift during one-half its travel and pull the other.

The real reason is, the friction of the straps on the eccentrics is tending to pull the links down in the forward motion and to lift them up in back motion. In an engine with very short eccentric rods the pull is greater, because the leverage is shorter; with very long rods you have the advantage of the long leverage, and the pull is less preceptible. While it is of no importance, so far as practice is concerned, what we *think* causes the pull, like Josh Billings, I believe it "better not to know so much than to know too much that ain't so."

What do the draftsmen think of it?

Germantown, Pa PRIMER.

Feed-Water Heater Tests.

Editor The Locomotive Engineer:

In the November number of the *National Car and Locomotive Builder* you will find an article on a test of the Rushforth heater, and I am sure you will say the test was conclusive. You rather got the best of me when I called the St. Johnsbury heater a new principle, but think there has now been a test of a heater by a man who, to say the very least, is a disinterested party. G M. BOY.

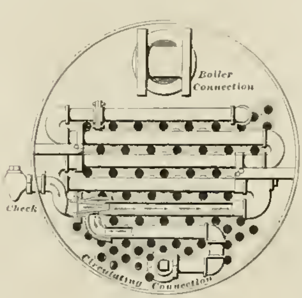
St. Albans, Vt

[Our correspondent cannot say more about the honesty and sincerity of Mr. Sinclair, of the *Car Builder*, than we will endorse; however, all flesh is liable to err, and in this instance we think Mr Sinclair did not know the exact conditions The Rushforth heater is a stand of pipes in the front end, as represented in the cut; the check is placed between the injector or pump and the heater, and the heater itself has two connections to the boiler, top and bottom.

The thermometer was applied to a nipple attached to the heater at the top connection to boiler. The thermometer stood at 353° before the train started, because it was virtually applied to the boiler. After the feed was put on, it fell 129 degrees, or to 224°, but steadily gained until it reached 260°. As an injector will feed water at from 140° to 160°, Mr. Sinclair presumed it fair to give the heater credit for 100° gain of heat.

Now, if you will look at the cut, you will see that just inside the check there is a nozzle—to promote circulation—and after the injector gets fairly to work, the water going through this nozzle draws in and mingles with itself water from the lower connection to the boiler, and the readings on the thermometer were only readings of a mixture of warm water from the injector and hot water from the boiler, and it was, of course, hotter than the injector would deliver, and colder than that in the boiler We have never disputed the claim that any of the devices made would heat the water, but the heat is taken at the expense of something else—simply stated, there is no waste heat in the front end of a locomotive.

The only real test of a heater would be to weigh the fuel for a series of trips, with a given load, both with and without the heater, and subtract from the record of the heater the cost of maintenance and interest on the first cost, and, in the case of the heater in question, the loss of the heating surface of two flues that have to be removed to get the heater in.—ED.]



The Block System.

Editor The Locomotive Engineer

Although not a railroad man at present, I take an interest in R R. matters, and take your valuable journal. Now, what is meant by "the block system"? and how is it operated? Please answer in your next issue, under the "Asked and Answered." B. F MAYWOOD,

1st Sg't. Co. "E," 3rd Infantry, U S. A

Ft. Snelling, Minn.

[Any system of running trains is a "block system," where, by the display of a signal at telegraph stations, one train is kept from going onto the track between the signal displayed and the next signal, until the preceding train has passed the station ahead. In England, and on some roads in this country—notably the Penna.—signal towers are placed beside the track, one mile apart. There is an operator in each tower, and as soon as he receives word that a train has passed the next station, he sets his white, or safety signal, and the next train can follow without even slowing down; as soon as the train enters the "block," he sets his red, or danger signal, and if a following train arrives before he receives word from the other end of the "block," it has to stop. The "block system" is the safest and surest way of handling heavy traffic. It is principally used on double-track roads, but can be, and is sometimes used on single track.—Ed.]

Ideal Overclothes.

Editor The Locomotive Engineer

When Adam was tending sheep and pruning Siberian crab trees in the garden of Eden, we are told that he loafed around in an airy suit, composed of a dwarf fig-leaf with worm-holes in it. Adam never ran a locomotive, without cone or netting—if he had, he would have looked as if he had been soaked for a generation in a tank of mustard plaster.

King Solomon's purple and fine linen, Cæsar's royal toga, and Queen Elizabeth's low-and-behold jersey were eminently fitting to the people and the time—but that was before the days of slipped eccentrics and double-headers, and history tells us that these eminent people lived so remote from the rest of us that they never saw a train of cars.

People who ride on our trains can encase themselves in linen dusters, goggles, and skull caps, and ask the conductor the same question 34 times in 24 miles, and never sweat a hair or soil the collar of their linen armor. Not so the men who are shoveling smoke and boiling water at the front.

While there are other men proud enough to wear overclothes—because they can't help it—engineers and firemen do so more regularly and more raggedly than other folks.

I believe with Henry George, that man's chief reason for living at all is to satisfy his wants with the least possible exertion—I have tried for years to get up a pattern for overalls and jacket that I could put on by simply laying down on them. The suits sold in the stores were not made for mortal man—they are a triumph of buttons, little cloth and big tags

They are too small in the leg for a man who has two wooden legs; one leg will shrink up long and thin—like an umbrella cover—the other will go wide and short—like the fatigue uniform of a bass drum.

The buttonholes are cut so that they will come unbuttoned, and the buttons so that they will come off with the minimum of tension.

They rip for fun and they bleach out for spite, and the shirt or jacket is just like the overalls, only worse. The buttons are six inches apart in front when new, and ten miles the first day out; the collar is nine sizes larger than the sleeves are long, and the cuffs are the same size of the collar. I rebelled against them ten years ago.

Some of the men on our road had clothes made by their wives that looked fairly well, and I got married, more with the idea of getting some decent overclothes than of keeping house. Mrs. A struck out the first week and borrowed a pattern, and got a receipt. I bought a bolt of blue denim, and we soaked it over-night to get the shrink out of it. Mrs. A had my written order to make the legs large enough so that I could put my foot through cross-ways, and could get into any known position and not have them tight any place—she did.

She was to double-seam everything and sew the buttons on with double-twisted and waxed silk—she did.

She was to make the front open far enough down to prevent ripping, and make the seat big enough to go on over my overcoat—she did.

But bless her dear heart, she made six pair after she lost the front pattern, and there was just as much slack in front as there was behind—I never could tell whether I was going to Boston or New York.

Those things did not bind, nor draw, nor shrink, but every wash-day the wringer chewed off a button or a huckle, and I often went around with the overalls hanging to my overshirt by the front slack and a nail.

One day I was down on the dock, and I stumbled onto an old salt with a pair of canvas pants on, and while I was sizing them up, he remarked that he was so hungry he was empty, and reaching around to his side, took a reef on a cord, and wrapped the end around a cleat.

After all these years, here was my ideal overalls, and before I left that man I knew more about his style of pants than he did, and had a pair for a pattern.

If a man has pockets in his overclothes, they will be full of old orders, matches and cinders, and he will always leave his knife and plug tobacco in them, and then go home and kick the dog—I have no pockets in mine.

I had some overalls made that had big legs, and were loose, and had slits down the outside of each leg for ten inches—you can reach through them into your pants' pockets for anything you want, and the slits prevent tearing in getting on or off.

There is not a button, a button-hole, a strap, or a buckle on my rig; buttons can't get lost, unbutton, or the holes tear out.

There is no front door to tear, keep unbuttoned, catch cinders, and make you swear.

There is a heavy cord drawn through a hem in the front and back; these are sewed fast in the center, to keep from losing them, and each end sticks out six inches beyond the cloth.

It matters not whether you have on only an undershirt in summer or are bundled up for winter, the waist of those pants always fit. They are easy to get in or out of, they catch no cinders, they are cheap, and they never lose a button at the last minute. As quick as I find a steel rope tempered in lightning to use in place of the cord—the best I can find will wear out and break—I will have a perfect thing.

Mrs. A. says a man with as big feet as mine ought to have his pants made to go on over his head—but she is prejudiced. I want something to keep the dirt off my clothes, and I would rather look like I had shrunk a little and had room to grow, than to look like a second-hand mummy swathed in blue bandages. This overclothes business is not a theory, it is a condition—a buttonless condition with a rip in it. JOHN ALEXANDER.

Get your old piece of belting out that covers the slot around the reverse lever.

Pumps That Won't Supply.

Editor The Locomotive Engineer :

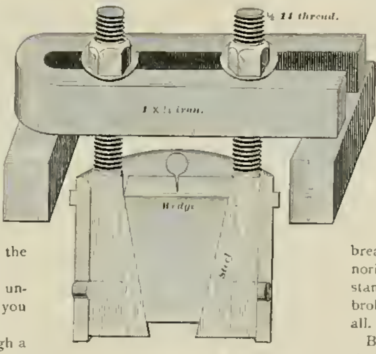
I am a young runner, and have an engine to care for, and am in a little trouble. The pump on the right side will not feed the boiler; it throws a good stream from the pet cock. I have had the pump taken down, and the machinist claims there is nothing the matter with it. The question is, why won't the pump supply the boiler? I started out of a side track the other day, and had four cocks of water, and before I had gone two miles, the last two of them were gone, using the right pump all the time.

Now, if there is nothing the matter with the pump, as the machinist claims, I can't see why it won't supply the boiler. Please answer through your journal what you think is the trouble.

JOHN F. MCCORMICK.

Hallstead, Pa.

[You do not give data enough. We cannot tell what service your engine is in, or whether the pump is large enough to supply the boiler or not. Presuming that it is, we should suggest that, if machinist has found valves in pump itself all right, you have him look at the check to see if it has lift enough, as you say pet cock throws a solid stream. If check is all right, look to the lazy cock and strainers; perhaps the pump is starved. The writer has had trouble of this kind from the lining of the water hose coming loose and partially shutting off the supply. —Ed.]



RELYEA'S BUSH REMOVER.

Tool for Removing Air Pump Bushes.

Editor The Locomotive Engineer :

I was pleased with the illustration of tools in October issue, designed by H. R. Jones, especially the iron fingers. I have made a pair of steel, and they work like a charm. I hope Mr. Jones will come again.

The air pumps on N. Y. C. & H. R. R. R. engines are hung just above the driver brake cylinder, with just room enough to get off the bottom head of air cylinder. So, in order to get the lower discharge valve out, I have heretofore used pieces of ½" gas pipe 4" long, to push the valve up. But I found that kind of rod too inconvenient, so I made a flexible rod by winding a close spiral spring, about ¾" diameter of No. 12 wire, and 18" long; this does the business nicely.

For removing upper main steam valve bushes, I use an arrangement or "combination" like the drawing; I think it will explain itself. W. F. RELYEA.

Syracuse, N. Y.

Driver Brakes.

Editor The Locomotive Engineer :

What public sentiment demands at the present time is not theory, but results, and to produce the best results in railroad operating is now largely left to the ingenuity of the railroad mechanic. Public sentiment now expects that all the available power be applied at a moment's notice by the man who first sees the danger. As we have already utilized the cars and tender for this purpose, the next step is to apply it on the engine also. In all short local trains, which run fast, make quick and numerous stops, the engine alone weighs as much as two of the coaches, and without driver brakes the coaches have to stop the engine as well as themselves.

Some of the master mechanics do not believe in their use at all, and others complain that they "can't use the driver brake on their equipment because the men shake things up so." This is all wrong, and we engineers should be glad to see all the brake power supplied that can be used. It is a puzzler why engineers should object to using the driver brake when it is on their engines, but some of them do. Some engineers keep it cut out and will not use it, because they think it breaks the driving boxes and frames, ignoring the fact that, where it is used constantly and judiciously, fewer boxes are broken than on the roads not using it at all.

Brother engineers, don't let us stand in the way of improvements which tend to protect our lives and situations. How many slight collisions could have been avoided altogether, and the force of more disastrous ones made lighter, had good brakes and more of them been where we could use them ourselves at a moment's notice?

How many good engineers now out of work would be happy in the possession of good jobs, had a driver brake been on their engines, in working order, when they wanted it worst?

When a man wants to stop, to avoid an accident, he wants to stop awful had, and every means should be at hand to make that stop.

Some of us stood out against injectors ten years ago, and declared that they were no good; that the only way to feed a locomotive with water was with a pump; but those engineers had to step one side, or get walked on by the column of improved devices that have been successfully used on the locomotive of the present day.

CLINTON B. CONGER,
Mech. Eng., State R'y Commission.
Lansing, Mich.

Handling Air Brakes.

Editor The Locomotive Engineer

In article on Air Brake Practice, in August number of THE LOCOMOTIVE ENGINEER, occurs this observation: "Ordinarily, with air brakes in good order, a reduction of 3, 5 or 8 lbs. air pressure, according to number of cars in train, rate of speed running and kind of grade approaching stopping place, will give good results."

In September number of THE LOCOMOTIVE ENGINEER, H. S. H., of Denver, Colorado, takes exceptions to the above, as follows: "We would like to know *what difference the number of cars makes* as to reduction of pressure necessary to make a stop. On a train of 20 cars it is necessary to exhaust more air than with 5 or 10, but the amount of pressure need not vary. We claim this on the ground that, in each case, all things, outside the number of cars, are equal."

This is followed up by H. S. H., in November number of THE LOCOMOTIVE ENGINEER, as follows: "Now, Mr. Editor and readers, if the statement I made, that it was necessary to exhaust *more* air from a train of 20 cars than from one of 5 or 10, in order to reduce pressure a certain number of pounds, does not carry the idea that we take into consideration the number of cars in train in handling the automatic, I will retire, and give J. E. Phelan a clear field."

"Now, Mr. Editor and readers," it is very evident to man up a tree, that H. S. H. rushed in for September where he would not have rushed if he had taken time to consider the matter he took exceptions to. THE LOCOMOTIVE ENGINEER is a good subject for study and consideration, and its friends should not bite off more than they can chew.

Readers should bear the fact in mind that in air brake practice there is quite a margin for individual skill and intelligence, but to the engineer with a train of 20 ordinary air brake cars, more or less, I repeat, always take into consideration the number of cars in train, and know that the greater the number of cars in train, the more the quantity or volume of air required with proportionate indicated reduction in pressure on the gauge. Respecting October observation as follows, "In handling the greater volume of air, as pressure is reduced by engineer's brake valve, it starts from forward cars first, and the space is filled on forward cars by air flowing from rear cars, and, before triple valves will act uniformly, it is necessary to have an even flow and reduction started uniformly, the entire length of cars or brakes in use. This naturally requires *more* air, more time in flowing from engineer's valve, and a consequent and proportionate reduction in pressure on guage," particularly so on old style brakes.

Brainard, Minn. J. E. PHELAN.

Firing Anthracite Coal.

SECOND PAPER.

On nearly all hard-coal roads the usual "hostler" of soft-coal roads does not exist, but in his place we find the "watchman of the roundhouse." The "watchman" does not leave the roundhouse to take charge of incoming locomotives, nor does he take locomotives out to coal up and make up trains; instead of that, all locomotives are delivered up to him by the men in charge in their stalls, in the house, and also taken from there by the enginemen. Each hard-coal fireman is expected to be at the roundhouse at least thirty minutes before the engine is to leave the house, to get his fire down, and do other preliminary work. In the present instance, however, we propose to consider the treatment of a locomotive which has no fire in it, having been washed out or under repairs. When such is the case it becomes the duty of the watchman, or some of his helpers, to "fire up the locomotive," as it is a matter of some time to take a boiler filled with cold water, and bring it to the boiling point, and then to a moderate steam pressure.

A supply of wood is usually put on the tank, before the locomotive is put into the house to be "cooled off," and this being at hand, the watchman or his helpers proceed to start the fire. This is done by saturating a few bunches of waste with kerosene, lighting and throwing them into the front end of the fire-box. The smaller sticks of wood being selected, we soon have a lively fire, warming up the sheets and flues. I have found it best not to raise steam too quickly, thus avoiding too sudden and quick changes of temperature and expansion; and have also found that a fire ought not be built the full length of our long (8 to 10 ft.) fire-boxes, for wood must have a large quantity of air for free combustion, hence, by building a fire in the forward end of the fire-box, filling, say, about half the grate surface, and leaving the fire-door open, sufficient air is admitted to make a bright fire, comparatively free from smoke; but if the whole box is filled with wood, prudence compels you to close the fire-door. When the door is closed, the fire does not obtain air enough for a free combustion of the wood, for there is not sufficient draft to cause a suction at first. Feeding the fire at intervals, in about 1½ to 2 hours after starting the fire, we have a few pounds of steam, say about twenty. The blower is then put to work to draw the smoke and flame up the stack, while an even layer of wood, about 15 inches thick, is placed over the whole grate surface. After this is done, the hard coal is shoveled on top, in an even layer of, say, a foot thick. This should be broken up in size of about 5 to 8 pounds, and carefully spread so as to leave no "holes," where the air could rush through unchecked. When the locomotive is taken out with a new fire in, the fireman will have to watch the fire carefully as the wood is burned out, and fill up any holes or low spots that may have been left in the fire, and he will soon have a bed of live coal, say 33x100 inches, and one foot thick. The Baldwin fire-boxes have their grate bars about 18 inches below the fire-door, while the Dickson, Rogers and Cooke locomotives, range from 16 to 20 inches deep at the door, to about 12 to 16 at the front end.

A new fire that has settled to a foot thick all over the grates in a Baldwin, will suffice to do light work with an occasional feeding, say at intervals of one mile, or, if worked harder, at a less distance; but if real hard work is to be done, the fire should be put in about even with the fire-door, or about 18 inches thick, and running about the same depth all the way to the front end of the fire-box. The sides of the fire against the side sheets should be kept from 4 to 6 inches higher than the center, thus leaving a depression running lengthwise of the fire-box in its center, or, as the boys express it, "building it hog-trough fashion."

The Baldwins are generally sure to make steam, but not very freely; but they will also "hold their steam" while "being fed," hence in "feeding" a Baldwin on the road, three to five shovelfuls can be applied at a time, and if done quickly, the door can remain open while it is being put in. The aim of the Baldwin fireman should therefore be to carry a nearly level fire (excepting the rising sides), and keep it at that by feeding along the sides alternately, and as the parts are being worked by the exhaust.

The other classes of locomotives will have to be treated somewhat different, for they need what the boys call a "wedge shape fire." After the new fire has settled uniformly over the grates, the fireman will aim to have the front end of fire about ten inches thick, and ascending from that at a steady slope to the fire-door, where it is from 18 to 24 inches thick. As a rule, the "Cooke" will require the heaviest fire of any at the door, while a few of the Dickson and Rogers build also want at least 12 to 14 inches of fire in the front end, and somewhat heavier back. VULCAN.

Air Brake Practice.

SEVENTH PAPER.

BY J. E. PHELAN

Though automatic air brake appliances are being successfully handled on thousands of miles of railroad, few, excepting the engineers who know how to skillfully handle the brakes, and the observers, who know how the brakes should be handled, really understand the real care required to insure smooth service and good air brake practice.

With cars coupled closely with Miller or Janney, or other styles of close couplers, and but few cars in train, air supply and air brake appliances can be used, and often are used, without regard to manner or effect, so long as stops are made.

All that seems to be considered for haphazard work is to turn the handle one way to set brakes and then turn it another way to have brakes release. This apparently being all thought of, or considered by many in days past, and a few lingering specimens in the present. But air brakes are now moving into an extensive field and instead of being confined to a few engines in passenger service, they are in many instances being applied to all kinds of equipment; and knowledge of air brake practice must form part of a locomotive engineer's ability in the future.

The good air brakeman will learn and always know what every movement of the engineer's brake valve means, and what each motion leads to, in use of air supply; where that air supply comes from, and where it goes, and the part it performs in response to handling of the engineer's brake valve and the needs of the train.

So far as trains made up of a few cars are concerned, if such were mainly in hand for air brake appliances, and no increase in number of cars required, the automatic air brake could have gone along, and come along, in comparatively simple style, with the old 3-way cock for an engineer's brake valve to regulate the supply of air to the uses of the triple valve; and the triple valve to automatically utilize the supply of air (in effective work) given to it through medium of engineer's valve, without necessity of improvement.

As the number of cars in trains has increased, and having the automatic brake applied to each car in train, so have air brake appliances improved to meet the requirements of increased tax on designed action, and the cause for this improvement has been that an automatic or self-acting brake might be applied to each car and always kept in readiness for use in emergency, when running on the road. Having cars, especially in freight service, expensively equipped with air brake appliances, the service should have the benefit of every such brake in train, and each car so equipped should be connected with the engine, and have its supply of air ready for use in any emergency.

Men often make the assertion that ten cars, more or less, of air brakes next the engine is all that is needed for service intended. Men making such assertions imagine air brakes are placed on cars so that brakemen may have an easy time, or that air brakes are only to be used for stopping at stated intervals. But the principle of automatic brakes and the cause of its being on all cars should not be lost sight of. They are placed there to prevent accidents, and it should be borne in mind that broken rails, broken axles, etc., do not always commence to play havoc with a train within ten cars from the engine. A train does not always choose to break in two within these ten cars, but when only this number is in use, and train breaks in two back of such point and causes damage, it brings in some awful forms of excuse; but the boys never lie.

Increasing the number of cars in trains to an indefinite number, and requiring a brake on each car in such trains to act automatically and promptly for reliable work, has required improvements until we now have an engineer's brake valve and improved triple valve, meeting the requirements of the circumstances. These improvements in turn call for close couplings and but little slack, to make the service what it should be for all occasions.

With a full train of closely coupled cars, equipped with quick-acting triple valves, and operated by an improved engineer's brake valve, we find an outfit made up with a view of lessening the bad effect of poor handling of brakes or bad air brake practice.

But scattered about among the various equipment of railroads will be found to-day, and likely to remain in service for years to come, thousands of air brake cars equipped with link and pin couplers, and among them find the various stages of improvement in air brake appliances—the earliest good enough for fair work, and far too valuable to be thrown away.

Take a freight train of 20 to 40 freight cars, with link and pin couplers, variously equipped with old style and quick-acting brakes, with all brakes only in average condition, and it makes a combination on which the average engineer looks with dread. The engineer who handles this fruit of genius made up into an air brake train, without unusual slack, before having considerable experience, must be acknowledged a dandy, and a good student in thought and action. But trains *can be handled* fairly under such circumstances.

Automatic air brake practice now being comparatively in its early stages in many sections of the country for freight service, the object should be to throw out practical suggestions to prompt thought and study, that will in the end produce good results.

The skillful engineer must often make up for, and overcome by his good practice, defects in machinery and appliances. While an engineer may not be open to censure for doing poor work with indifferent appliances, it must stand out as greatly to his credit in doing good work under unfavorable conditions, while it must show up the man in very poor light, who cannot do fair work with the best of modern improvements.

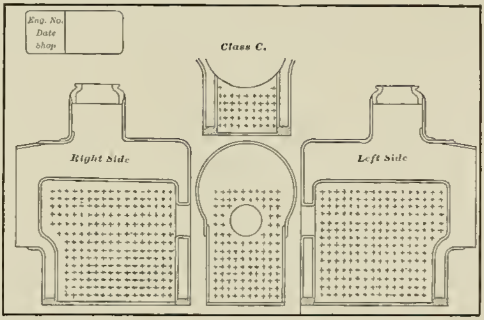
Rigid Boiler Inspection.

At the Renovo shops of the P. & E (now Penna.) they have a very safe system of boiler inspection.

Once in six months the boilers are tested by hydrostatic pressure to 25 pounds above their working pressure, and during such test a man is placed inside the fire-box and one outside, to listen for fractures. Safety valves and steam gauges are tested every month.

Every week an inspector makes a hammer test of all stay bolts, and he is furnished with a blue print card, showing location of every stay bolt in the fire-box; if he finds one broken he crosses or checks it on the card, and the engine does not go out till it is repaired.

The cut shows card for a consolidation, and is half size. Duplicates of these cards are filed in the office, and any number of years afterward the record of inspection and work on each boiler in the service can be determined



Enlarging the Wilkesbarre Shops.

The Lehigh Valley road are making some needed improvements in their Wilkesbarre shops. They have completed a two story oil and supply house, 25 x 50; a tool room and pattern shop, 25 x 50; and a carpenter shop, 60 x 110. They recently built a new boiler shop, so that the painters are nicely fixed in the old shop, and the machine shop will get all the room now occupied by the carpenter and pattern shops and the tool room. The road has also put up a coal chute of simple design, nine pockets, holding from four to six cars of coal each, and a device whereby the engines can take as much as they want; the chute is high, and under the bins there is a storehouse for odds and ends.

The track is above the chutes, so that dump cars can be unloaded into them, and one man is all that is needed in the building.

The foundation is partially down for a thirty one stall roundhouse.

The shops are quite busy on repairs, and are also building a number of new boilers to replace old ones in service. The shops are now under the charge of Mr. Fred. Ross, who succeeded the genial Mr. Drumheller, deceased.

These shops are under Mr. Alexander Mitchell, M. M., and Supt., who, in Feb., 1866, designed and built the first consolidation locomotive, and two years ago turned out, but did not design, the big Strong engine—the Duplex. One has become the most popular locomotive on the continent for freight service, the other is, as yet, a case of doubt

They are putting new boilers on several freight engines.

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STANDING NOTICES.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

☞ *Mailing address of Subscribers can be changed at any time. Both old and new address should be stated. Prompt notice should be given whenever papers miscarry.*

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CONTENTS.

Close of Volume I.

With this issue closes the first year of our existence, and the index for the year will be found herewith. The index is intended to aid regular readers in finding articles as they remember them by the headings, and the matter has also, in many instances, been indexed, so that matter bearing on any one subject can be found by referring to the subject itself.

Experience has proven the correctness of our original assumption, that the great majority of mechanical papers were aimed too high for the average railroad mechanics, and treated on altogether too many subjects foreign to their occupation.

The year's experience has also shown that what is of interest to the men on the engines, and in the shops, is of interest to the master mechanics and superintendents over them—as the names of prominent master mechanics, traveling engineers and general foremen, that have appeared in our correspondence columns during the year, will attest.

We do not propose here to pat ourselves on the back, or make any rash promises of future greatness, but will simply say that, in the year to come, we shall try harder than ever before to make the paper interesting and instructive, its aim being to "raise the grade," mechanically, morally and financially, of every man in the service it represents.

An Avalanche.

Last month we made some inquiries about steam-pipe repairs, and at this writing, Nov. 20th, we have received 143 replies. To publish all these letters in full would fill three such papers as ours, and we have therefore been obliged to cut down the letters to the three most important items: How often done, how long it takes, and how much it costs. Then, by publishing about half this month and half next, we will be able to show up the practice very fully.

Twenty-one foremen have answered the questions, and say that it is against the rules of their road to publish such information, or simply marked "not for publication." To question about special tools, 105 say they have no special tools except wooden block to hold rings; 26 say they use a brace and rose bit; 4 send sketches of ring holders or rose bits, and 13 do not answer at all.

As to who does the work, 36 say men take turns, 42 that they use the first man they come to, 4 keep a regular man, and 16 that boiler-maker does the work.

Seventy-six say that engines do not lose trips for this work.

Thirteen report the use of valves to prevent over-pressure on pipes and steam chest, and 9 of these say they note no difference on pipe repairs.

Sixty-two say freight engines require the most work, 39 that passenger service is the hardest, and 16 say they note no difference. Only 7 report the use of clips or bridges over lower joint, 5 report the use of cement, and 12 the use of iron cover over lower joints on extension fronts.

The time between grinding varies from one month to ten years, and the cost from $1 to $20. A majority mention that the cost and time are about double on extension fronts over short fronts, and all but 4 who report a loss of a trip say it is on account of the heat of extension.

Taken altogether, the replies are interesting, and show what interest and care for details is taken by the roundhouse foremen of the country. Those replies crowded out of this issue will appear in the next.

What is Under Control?

Recent accidents, where it is claimed that engineers disregarded the order to approach certain places "under control" have raised the question at the head of this article.

Once upon a time in our experience, we were taken to task by our superintendent, for passing a certain point with a freight train at about 15 miles per hour; when we asked him to define "under control" he was at a loss for an example and we finally asked if he would call a train under control if it could be stopped inside of its length; he thought it was, and we got out of the scrape by assuring him that, with the excellent air we had on every car, that we could kill 15 miles per hour much short of forty cars—we were both wrong.

One very good definition is, that under control is to have your train so that it can be stopped inside the distance you can see—if you can see but 100 feet, the train should be run slow enough to be stopped in that distance; if a mile, a higher rate of speed would be under control.

This is a pretty safe rule, but circumstances alter cases; for instance, if ordered to run under control past a point within plain sight, but in bad weather, or during the prevalence of freshets, an engineer would have to use his good judgment, and no set rule should be followed.

It is always well, however, to have a perfect understanding between the engineers and the officers to whom they are responsible, and when a superintendent is found who says six miles per hour is under control under all circumstances, it is better for the men to run six miles per hour, than to argue on the green carpet about what under control really is.

Burning an Engine.

There is a disgrace attached to a runner who allows the water in his boiler to get low enough to burn the crown sheet, that he never entirely outlives. Not only does he get, as a rule, his dismissal from the service, but his reputation follows him, and, a few years back, he was lucky if his superior officer did not blackball him instanter. But this was not the end of his misfortunes; if he happened to have a few enemies in his brotherhood division, they would insist on the enforcement of a law expelling him, and publishing his name in the official organ of the order, as expelled for "burning an engine."

All these reasons combined tend to make a man sacrifice all other considerations to keep water on the crown sheet; and any runner would rather tear off both cylinders and all the link motion, than to scorch the rafter bolts even a little.

That, with all human care possible, this disaster will occasionally occur, only goes to prove that humanity is prone to slip up in its calculations.

It is seldom that a crown sheet comes down and injures anybody, and it costs much less to repair one than it does to repair wrecked cars and broken heads caused by a collision; and, no matter how much a runner is at fault in this case, his fellows do not expel and disgrace him.

When a man burns an engine through incompetency, gross carelessness or intemperance, he needs discharge, expulsion and disgrace; but if a man with a good record as a runner makes a mistake, is overworked and goes to sleep, or is deceived by changed conditions, or hampered by inferior boiler feeders or bad water, he does not deserve the lifelong punishment he receives.

When a runner, to keep from burning his boiler, carries water so high that it is constantly carried over into the cylinders, he annually costs his company more money for repairs than if he scorched a crown sheet regularly, on each and every New Year's morning

Last month an engineer on the Lehigh Valley road dropped the crown sheet of the "Bee," No. 82. The immense crown sheet came down where the ash-pan ought to be, blowing a man off the tank, and killing him. The engineer was a runner with a reputation, and an experience of nine years on the road, and he honestly said that he would have sworn, one minute before the accident, that he had three gauges of water, but since looking at the sheet, he was satisfied that he did not have any. Such a man feels his disgrace, and is punished enough, without any action on the part of his brothers. Men who cause, or may cause accidents of any kind, because they are incompetent, intemperate or ignorant, should be expelled, or, better, kept out of the orders in the first place.

Burning an engine is bad, and should receive punishment; but it is no worse than a hundred other things that men do and are excused—because they are good men—why not be a little more lenient for this offense?

The engineers should bear in mind that it is the sinner, not the saint, that needs salvation; and officials, that it is no more dangerous or expensive to scorch a crown sheet by not using water enough, than to use double the amount of oil and coal, and cut cylinders, valves and seats, and tear valve motion to pieces by using too much.

The trouble is that the burning process takes place in a few minutes and is a shock, while the drowning process takes a year or so, and we get used to it before the final collapse. Both are death—one by lightning, the other by consumption.

The Pennsylvania Coal Premiums.

The Pennsylvania R'y. Co., instead of offering a premium to the man who can run on the least coal for a month, or six months, go on the principle that when a man saves a dollar for the company he is to get half of it. Each month they post at all roundhouses on each division, a list of the trains on the road and the limits of coal they are expected to run under. The trains are allowed so much coal per car per mile, some on the New York Division as high as 24 pounds per mile, and some as low as 3.8 pounds. The company allows nothing for taking the engines over the road, except when light; this is unfair, as the man with the big train has an advantage always; if a man has one car only the coal used to run the engine is all charged to that car, and if he has a hundred cars it is divided up into a hundred pieces; they ought to allow so much for an engine under all circumstances.

When a crew run under the amount allowed by the bulletin for a month, both the engineer and the fireman receive 60 cents per ton for all coal saved, and the extra money made by some of the best men is enough to keep them in clothes. This plan is superior to the prize plan, as it gives every man a chance to profit by his care, intelligence and devotion to his business. There are many men on the Penna. R'y, however, who always burn more than the amount allowed to their trains, and they are only occasionally asked the reason.

This idea that railroad men have been pushing for years, that one is as good as another, is dead wrong. There are engineers and engineers. Let us liken a road's force of engineers to a beef carcass; now, suppose we cut up the whole beef into slices and call it steak, there will be some choice cuts of porterhouse, about twice as much fair-to-middling round steaks, and a whole mess of neck and heels. Don't be the tail.

Books Received.

ANNUAL REPORT OF COMMISSIONER OF RAILROADS OF MICHIGAN has been received; like all other reports of its kind it goes into the financial details of all the roads, and also states all the progress made during the year. Last year the legislature of that State provided for the appointment of a mechanical engineer, who should have at least ten years' practical experience. The commissioner appointed Clinton B. Conger, an engineer, and in showing up the work this man has done for the good of the employes, the safety of the public, and the profit of the companies, in language that we very much regret space forbids repeating here, he says: "I think the results of the first year's experience fully demonstrate the wisdom of the legislature in deferring to the request of the railroad employes in the employment of a mechanical engineer to be taken from their number" Many recommendations of Mr. Conger for the safety of trainmen are embodied in the report, and are worthy of the man and the time

POOR'S DIRECTORY OF RAILWAY OFFICIALS contains list of officials of all roads in United States and Canada, and Great Britain and Ireland, also street-car lines, lumber and logging roads, etc. This is the third annual number, and issued as a supplement to "Poor's Manual of Railroads." It is the most complete and reliable list of this kind as yet compiled

GRIMSHAW'S BOILER CATECHISM, Practical Publishing Co., 21 Park Row, has been received. It is elementary, and very much on the advertising line, as almost every cut and description used are of boilers or devices patented or manufactured by some firm. The work is not intended for, and would be of very little use to locomotive engineers.

DIXON'S MACHINIST'S AND ENGINEER'S CALCULATOR, D. VanNostrand, 23 Murray street. We often receive inquiries from firemen and apprentices—and often engineers and machinists—who want a book on mechanics, with tables, etc., but in plain, elementary language, and in which simple arithmetic is used in place of algebraic formulæ and technical phrases, beyond the understanding of men in possession of common school educations only. This is a book of this description, is bound in morocco, in pocket form, and contains rules and tables that would be of great service to young students. It has a chapter on locomotives, full of points and "reasons why," and has a description of an injector that is the one commonly given to firemen by their engineers; it is very brief and a little shady—if not entirely incorrect

The C. B. & Q have recently turned out some passenger engines with solid-ended rods all around, even the back end of the main rod. Their performance will be watched with interest.

ASKED & ANSWERED.

(68) Apprentice, Rome, N. Y., asks:

Who invented and first used cast-iron steam pipes, and when was it? *A.*—Wm. Mason, of Taunton, Mass., in 1853

(69) D. M., Taunton, Mass., asks:

Do you consider the braces usually placed between the boiler and the frame a necessity? *A.*—If the engine always remains on the track, no. But if she ever gets a tumble, we believe the boiler braces will save lots of broken and bent pieces.

(70) Virginian, Alexandria, asks:

Is there any known torpedo placer that will drop them from a running train, and if so, how do they work? *A.*—Yes, by employing torpedoes having a spring steel strap instead of one of lead or tin; these steel straps are sprung open and held so in slots in a forked iron head on a wooden handle long enough to reach the rails from the rear platfrom. By placing the fork over the rail, and giving a quick punch, the torpedo is jerked out of fork, and the springs firmly clasp the rail. They are in use by a number of railroads.

(71) Texas, Galveston, writes.

In a recent discussion on what constituted an "American engine," I mentioned as one of the distinguishing features the bar frame, and was at once pounced upon by several, who claimed the bar frame was first used by Compton, in France. I could not back up my statement, as I did not know. Can you enlighten me? *A.*—The Compton engines have a slab frame. The bar frame, as now universally built in America, was, so far as we know, first used by Wm. Mason, 1853-4

IN THE ROUNDHOUSE AND REPAIR SHOP.

Covering iron decks with inch boards makes them warm, and prevents accidents from slipping.

* * *

There was only one railroad accident in England last year in which passengers were killed, but that one was enough—25 killed, 92 crippled.

* * *

The *Engineers' Journal* could make us happier if they would credit items they use, that originally came from this sentiment foundry.

* * *

The Jacksonville, Tampa & Key West shops at Jacksonville, Fla., and the New Orleans, Texas & Pacific, at Ludlow, Ky., have recently equipped their shops with the Vreeland transfer jack.

* * *

Steam car heaters are scrambling for trial and adoption. If this should be a very severe winter, it would go a long way toward the correct solution of the problem.

* * *

At the Renovo (Pa.) shops, we noticed an old English slotter, too much worn to do accurate work, that was doing very good service as a punch in the blacksmith shop.

* * *

Most English locomotives with outside cylinders have the steam chest inside the smoke arch. No doubt this method prevents radiation and saves coal, but it must be very unhandy about repairs.

* * *

The *Firemen's Magazine* will be enlarged to 94 pages. The *Magazine* is a grand, good one, but we believe it would have been better to drop the resolutions on deaths, and leave the book its present size—it is already worth more than one dollar per year.

* * *

We have received word from the manufacturers that the cases of the locomotive clock, shown in our last paper, are not steam gauge cases, but special cases made for that purpose, and the dials are finely painted ones on zinc.

* * *

All boxes for locomotives, whether for tools, oil or clothes, should have a cover the full size of the box, so that, when opened, all cinders and dirt on them will be thrown away from the box, and not into it, as the hinged arrangement provides for.

* * *

The A., T. & S. F. have cut down the hours in shop service 16 per cent. They are reducing expenses in every possible way—in the shops—to make a better showing on the dividend sheets. Taking dividends out of running repairs or bridge timbers is like an exposed army withdrawing its pickets.

* * *

Some of the very best cylinder lubricators in use on marine engines are open cups, the feeding being done by a small pump operated by the moving machinery; they are simple, feed as long as the machinery moves, and stop feeding when it stops. They require no glass tubes or steam-tight joints, and we know of no good reason why they would not be a success on a locomotive.

* * *

At the Wilkesbarre shops of the L. V. R'y we saw a Wooten boiler in for repairs, that had broken nearly 150 stay bolts in the fire-box. This was one of the older designs, and had a light channel bar, instead of a solid mud ring. One year ago this same box had over a hundred new stay bolts.

* * *

On the D., L. & W., there are a number of locomotives that have been in service for five or six years, that use a solid cast-iron driving-box—no brass or babbitt at all. These boxes have given entire satisfaction. Would not a few experiments in this line pay most any road—especially those using moderately light engines?

* * *

An engineer on a D., L. & W. passenger engine, was badly hurt not long since, by being struck by a mail catcher placed near the track; it was ordinarily far enough away, but it is supposed the man was leaning far out of the side window to see the overflow pipe of his injector—one of those abominations that is turned inside the frame. The best place for an overflow pipe is where the runner can see the discharge end of it.

* * *

The Manhattan Elevated R. R. Co. is trying some experiments just now with a view of utilizing a cheaper grade of coal than they are now using. Engine No. 93, built at Rome, N. Y., cylinders 11x16, driving wheels 42 inches, grate surface 55 inches long by 44 wide, 125 1¼-inch flues 8 feet long, 4 inch nozzle, train 5 passenger coaches with Lehigh pea coal the engine did well enough to indicate that, when the men are familiar with using the fuel, it can be made a success in that class of engines. It is intended to try the buckwheat coal at an early day. E. J. Rauch, general road foreman of engines, has charge of the tests, and this fact alone insures a fair, free trial, and success, if success is to be had.

* * *

Where is the man who makes felt headlight wicks? Some makers send out felt wicks in new headlights, but the roads furnish canton flannel, and the man in the supply house will tear off a piece that looks as if it had been gathered for a doll's dress. We don't know what canton flannel is furnished for, unless it is the well-known fact that it makes the poorest kind of a wick. It is a nasty job to get one in at all, and then it is seams, and lumps, and feather edges. It would pay any company to buy good, ready-made, seamless wicks, if they cost $1 apiece; it would pay any manufacturer of headlights to put four dozen in each headlight case; it would pay any engineer to buy them instead of making excuses for wicks and swear words without excuses; and it would pay any man who makes these wicks, to advertise them.

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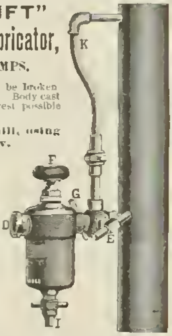

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Feed will not Chill, using the hardest Tallow.

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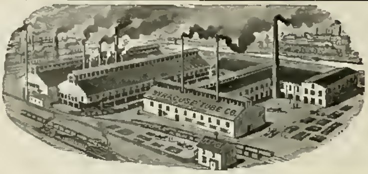

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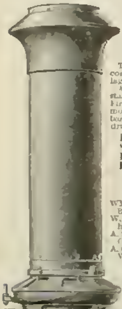

LUTTGENS' PATENT

Variable Exhaust Damper.

This device provides for the inside of a Locomotive Boiler what the application of lagging and casing provides for the outside. A circular valve is opened at the base of the stack, so that the cold air does not enter the Fire-box, the Flues or the Smoke-box, but it modifies the draft by admitting air at the base of the Stack or at a point where the draft is produced.

It effects a reduction in the coal bill.
Softens the exhaust.
Is a complete Spark Arrester.
Improves the steaming of the engine, and proves a comfort to the Engineer and Fireman.

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CLEVELAND, O., July 22, 1887.

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Highly recommended by American Railway Master Mechanics and others. Over 150,000 sold in Europe since first introduced, with increasing sales Highly recommended also by the U. S. Board of Supervising Inspectors of Vessels at Washington, D. C.; by Prof. R. H. Thurston, and many other eminent expert engineers, as superior to any now in use, and filling all requirements

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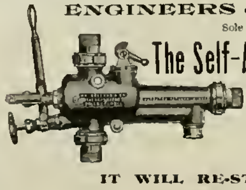

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Range of Capacity over 60 per cent., and can be regulated, therefore, to work continuously for light or heavy trains. Never fails to promptly lift hot or cold water.

No service on a locomotive sufficiently severe to permanently stop its working

IT WILL RE-START ITSELF

should the Jet break from interruption of the steam or water supply, as soon as the supply is resumed

ADJUSTS ITSELF

to varying steam pressures without waste of water. Increases quantity of water with increase of steam, and vice versa.

Very easily operated—Started by pulling out the lever, and stopped by pushing the lever in. Descriptive Circular & Price List sent on application to Office & Works,

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THE LOCOMOTIVE ENGINEER.

INDEX TO VOLUME II, 1889.

JANUARY 1 TO DECEMBER 31, 1889.] ILLUSTRATED ARTICLES ARE MARKED WITH AN ASTERISK, THUS* [96 FULTON STREET, NEW YORK.

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Correspondence

ASKED & ANSWERED

THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. I. NEW YORK, JANUARY, 1889. 1.00 per Year. or 10c. a copy.

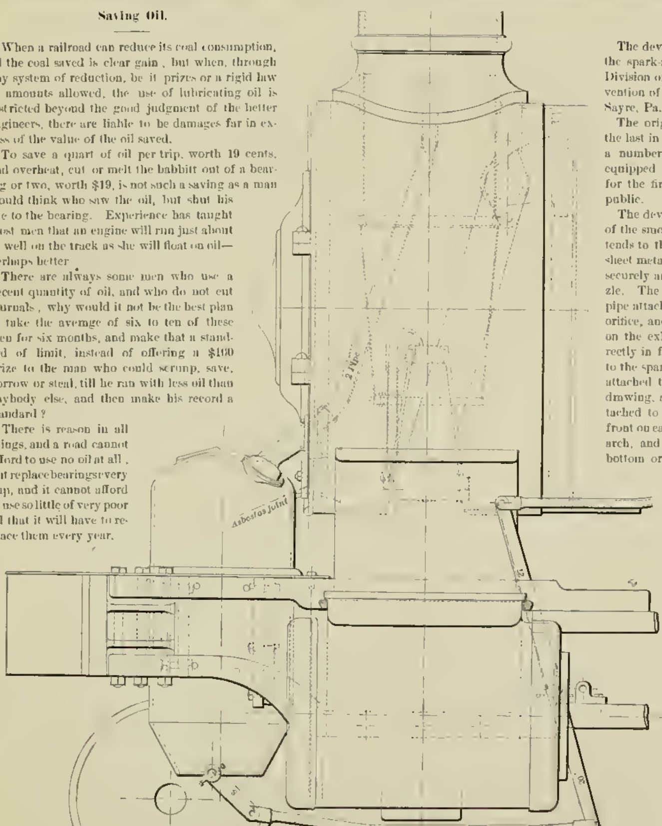
Saving Oil.

When a railroad can reduce its coal consumption, all the coal saved is clear gain, but when, through any system of reduction, be it prizes or a rigid law of amounts allowed, the use of lubricating oil is restricted beyond the good judgment of the better engineers, there are liable to be damages far in excess of the value of the oil saved.

To save a quart of oil per trip, worth 19 cents, and overheat, cut or melt the babbitt out of a bearing or two, worth $19, is not such a saving as a man would think who saw the oil, but shut his eye to the bearing. Experience has taught most men that an engine will run just about as well on the track as she will float on oil—perhaps better.

There are always some men who use a decent quantity of oil, and who do not cut journals, why would it not be the best plan to take the average of six to ten of these men for six months, and make that a standard of limit, instead of offering a $100 prize to the man who could scrimp, save, borrow or steal, till he ran with less oil than anybody else, and then make his record a standard?

There is reason in all things, and a road cannot afford to use no oil at all, but replace bearings every trip, and it cannot afford to use so little of very poor oil that it will have to replace them every year.



Weaver's Spark Arrester.

The device shown on this and the third page is the spark-arresting arrangement of the Northern Division of the Lehigh Valley Railroad, and the invention of Mr. J. N. Weaver, master mechanic, at Sayre, Pa.

The original patents were granted in 1876, and the last in 1884, and the device has been in use for a number of years, there being 130 locomotives equipped with it. It is now, however, shown up for the first time, as we believe, to the railroad public.

The device consists of an extension to the bottom of the smoke-stack, made of sheet metal, which extends to the top of an inverted cone of perforated sheet metal, the bottom of the cone being clamped securely around a flange cast upon the exhaust nozzle. The exhaust nozzle is provided with a jet pipe attachment, which projects slightly over each orifice, and extends downward through the flange on the exhaust to an L-shaped nozzle, located directly in front of the bell-shaped opening, leading to the spark receiver. The receiver or spark-box is attached to the front of the engine, as shown by drawing, and is provided with two suction pipes attached to its top, which pass through the engine front on each side, pass around the side of the smoke-arch, and enter the bottom of smoke-stack. The bottom or lower opening of each of these suction pipes is protected by a perforated metal screen, to prevent sparks from being drawn through them. The bottom of spark receiver is provided with double, butterfly valves, which are operated from the cab. The sparks can be readily dumped standing or running. At each exhaust of the engine, a portion of the exhaust steam is conveyed through the jet pipe, which is attached to the top of exhaust, producing, with each exhaust of the engine, a corresponding exhaust through the bell-shaped opening into the spark receiver, carrying what sparks may have been drawn into the smoke-box with it into receiver.

The action of the exhaust of the engine, in passing by the ends of the suction pipes in the stack, creates a suction through them, which not only assists in drawing the sparks from the smoke-box into the spark receiver, but carries off the steam from the jet pipe exhaust, allowing the sparks to drop to the bottom of the receiver, where they can be allowed to cool before dumping. It makes no difference in steaming of engine whether box is full or empty, as the front end is always clean.

The action of the suction pipes, in connection with the jet pipe exhaust, keeps the current through the bell-shaped opening into spark receiver almost constant, in an outward direction, thus preventing any admission of cold air into the smoke-box, so that,

Angus Sinclair is re-writing portions of his well-known book on Locomotive Engine Running. The new edition will have several chapters on combustion and other subjects, of special interest to, and for the instruction of firemen. The revision will add much to the value of a work already highly prized.

The Safety Valve copies (without credit) part of a letter from our correspondent, H. R. Jones, published in our last January number. Clippings are entitled to credit—if they are a year old.

At some of the P. R. R. shops, locomotives receive a general overhauling, including new fire-box, at a cost of $2,400. This is an exceptionally low figure.

whether the butterfly dumping valves are open or closed there can be no cold air taken into the smoke-box.

The arrangement and proportions of the apparatus are calculated to produce a uniform draft through the flues. The bottom flues remain clean and open equally with the top or middle flues.

This device takes the place of the extension front, and is in use on this road on many different styles and sizes of engine, some burning hard, others burning soft coal. It seems to be a cheaper and neater arrangement than the extension.

New Boilers on the Lehigh Valley.

Alexander Mitchell, Supt. and M. M., of the Wyoming division of the Lehigh Valley road, has recently built a number of consolidation freight engines with a new design of boiler. They have extra large grates for burning fine coal—fire-box is above the frame, like the Wootten—but the box narrows up to the width of the boiler about eighteen inches above the grate. He has built a number of these boilers, and has used the Belpaire system of direct stays, the crown bar and the radial stay, and the record of repairs and service of these boilers will do considerable to determine the relative merits of the different systems, as the boilers are exactly alike in every other respect, and the service the same. By narrowing the sides of the fire box, he gets a low running board to cab, and a full-sized door in the rear of it, so that the runner and fireman are not divorced or stand in need of speaking tubes, etc.

The arrangements of the cocks and levers in the cab were made for the comfort of the men who ride the mills—an unusual departure.

With the cab in the center of the boiler of long consolidation engines the riding is improved, and there is less demand for kidney remedies.

Rock Island Watch Inspection.

The Rock Island road have decided that all conductors, engineers, yard masters, train dispatchers, section and bridge foremen, and all officers connected with the operating department shall carry high-grade watches. They must contain fifteen jewels, patent regulators, and be adjusted to heat, cold, encased in anti-magnetic shields, and be examined by the company examiner every three months. Blanks will be furnished, to note any variations the watch may make. As long as the men own the watches these blanks will not be filled out truthfully, if filled at all. It is now considered justifiable to lie about the record of a watch, if nothing else—we have heard good, honest Christians who were running trains or engines, by an oroide case and a penitentiary escapement works, to solemnly swear that "She is just on the tick, and I ain't touched her regulator since a year ago last August."

The only safe, sure and right way for a company to keep absolutely correct and uniform time in train service, is to own the watches, and issue them every trip, the same as train orders; then, if a watch varies a sixteenth of a second a man will note it on a blank. But to report a fault with his own $150 ticker—not much!

The Rock Island folks have made one improvement—they do not make the men pay for the examination.

We can guarantee a poor return from the order to "compare time, and make note of difference on blank at least once a week."

Cleaning Work in Repair Shop.

At the Renovo shops of the Pennsylvania road they have a very neat way of cleaning the grease and dirt off the different parts of locomotives that go in to be overhauled; instead of wiping and scraping, they cook it off.

Just outside the machine shop there is an iron tank sunk into the ground so that its top is only a few inches above the level; it is wide enough to take in a truck and is perhaps four feet deep and ten feet long; one end slopes at an angle of about 30°, to facilitate the removing of pieces too heavy to lift bodily.

This tank is filled to within about a foot of the top with water, to which is added enough potash to make a very strong lye; into this is placed such pieces as it is desired to clean, and then the lye is boiled by steam from the stationary boilers.

For small pieces, such as bolts, nuts, washers, keys, etc., they have a small iron car with perforated iron box that retains them and makes the removal easy and sure. Such pieces as shoes and wedges, ordinarily so filthy, come out of this bath as clean as from a planer; one man can remove and clean all ordinary pieces from a large shop, if provided with proper truck, etc.

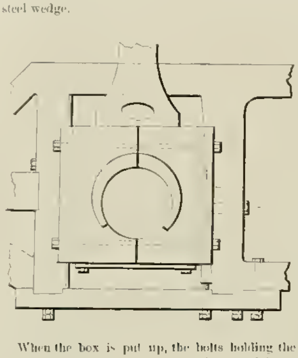
As the grease boils off it comes to the top, where it is easily skimmed off, and fresh water and potash are only required as the supply is reduced by evaporation. It would be a great scheme if some of these roads that are too stingy to wipe their freight engines would arrange a tank track near headquarters, where the engines could run through a half mile of boiling lye on the home trip; then, if they fixed up another tank of oil on the outgoing track, the engineers would not have to get off their seats to oil.

A New Axle-Box.

The axle-box shown herewith is the invention of J. Des Brisay, a machinist in the Canadian Pacific shops at Vancouver, British Columbia.

The idea is to make the box in halves and bolt them together to finish the bearing, etc.

The jaws of frame are lined with thin steel plates, and pockets in the sides of box carry small steel rollers that bear upon these plates. These rollers are made tight between the frame and box by a thin steel wedge.



When the box is put up, the bolts holding the halves together are slacked off, and the weight on the spring saddle above crowds the halves against the rollers and the frame.

The inventor hopes by this plan to do away with all devices for keeping the box lined up in the frame, prevent sticking, and keep the bearing on the journal closed up.

In the bottom of the halves is a large hole that is used to hold the cellar; this is made of any sheet metal, and is held in place by the plate shown on bottom of box. What success will be achieved remains to be seen, as the device has not yet been tried.

Read This—It Will Make You Tired.

LEBANON, Dec. 5 [SPECIAL].—Robert H. Coleman, the millionaire owner of the Cornwall ore mines, who is an expert mechanic, yesterday ran the 11 o'clock train on the Lebanon Valley Railroad from this city to Harrisburg. He did it for the purpose of making a test of a spark arrester of which he is the inventor. He handled the throttle with skill, and the sight of the millionaire engineer attracted a great deal of attention to the train.—*Daily Paper*.

[Here it is, simple enough when you see into it, the way to make all engineers handle the throttle with skill, and attract attention to their trains and their roads, is to employ millionaire engineers only. Of course, the regular engineer could not have tested that spark arrester—he did not have the million dollar skill.]

Air Brake Practice.

EIGHTH PAPER.

By J. E. PHELAN.

One of the principal causes of annoyance to be overcome in handling long and heavy freight trains, needing considerable air, is the heating of air valves and air cylinder of the air pump, and burning out packing. It is the same old cause mainly; where hurry commences, trouble begins. The air pump cannot be crowded beyond its capacity, and must have proper time to do its work. Often they are not properly cared for, and all kinds of dirty oil being used and allowed to be sucked in through air valves, dust accumulates and gum forms, until air passages become contracted, and adding to and increasing compression and friction in consequence, and pump laboring so much harder against unfavorable conditions, it has every inducement to get hot and stay hot. An air pump should work moderately and freely, and should not be crowded in its work. The pump should not be required to keep up more than 60 to 80 lbs. of air pressure in main drum for ordinary work. A pump will seldom heat working against this pressure, where it will often heat pumping against 100 lbs. pressure. Pumping against this latter pressure causes increased friction, especially when air is mingled with the ordinary amount of grit coming from a sandy road bed. The air cylinder should be shielded from such dust as much as possible.

Pumping air to supply leaking pipes, instead of the simple supply for uses of the brakes, makes a hard tax on the pump. It is poor economy to pump air and compress it to working pressure, only to have it leak from defective pipes back to the atmosphere.

An air pump ought to have daily attention of some kind. The air cylinder should be kept clean, and oiled with a small quantity of pure oil, free from gumming or corroding quality, that should be used and put in through small oil cock at top and back of air cylinder of pump for that purpose.

The duty of the present is to be skillful with appliances in use, and be ready to tackle anything the future may have in store.

To do successful work, waste of air in any form must be guarded against. All pipes and connections should be absolutely free from leaks and escaping air. The engineer who starts out, knowing that leaks in train pipe exist, cannot be depended on for good or reliable work. It should be known that brakes are in good working order before starting on a trip.

On freight trains, or any other train when brakes are in good condition, and all pipes and auxiliary reservoirs stored with air, it is a good plan to avoid application and use of brakes, except when necessary for the requirements of actual stops in service or emergency.

Aim to work the air pump as lightly as possible to supply air enough for the needs of the brakes in doing their work when skillfully handled. Don't make an air pump do in five minutes what may just as well be accomplished in twice the time with better results.

Nothing is more evident than the fact that, for successful air brake practice, the engineer must skillfully provide the amount of air necessary, by good judgment, in caring for his air pump, and keeping it in good order, and bear the fact in mind that the air pump compresses air enough, if too much is not used—similar to an engine steaming; very often a good engine's steaming qualities may be condemned because the man in charge can uselessly use more of the product than can ordinarily be supplied.

In the matter of air cylinders of air pumps getting hot, there is always a reason for it, and such reason should always be learned, and the evil remedied. If the heating does not come from the pump being run too fast, and forced into extraordinary action—and this may be relied on as the most common cause—there may be other defects needing a remedy. The matter of air passages gumming up, and cylinder becoming dirty, ought to be carefully watched.

One remedy for this is said to be gained by disconnecting discharge pipe from air cylinder. Then take a quantity of lye, and allow it to be sucked in through air valves and allowed to flow out where discharge pipe has been disconnected, where it can be caught and used over again.

Disconnecting air cylinder, taking off heads, and dropping it into a vat of hot lye, long enough to soften the gum and dirt, so that all passages and parts may be wiped clean, then putting it up again in good order, and keeping it properly oiled and cared for, and not overworking it, ought to ensure effective work without heating.

Where pump governors are in use, and no pump can be complete without it, a common fault is to start an air pump running at a rapid stroke, depending on the governor to stop the pump when required pressure is gained. Before pump governors came into use, air pumps were run at a moderate speed, and fear of excessive pressure governed the engineer's actions in controlling the pump. The knowledge of the pump governor's action, and confidence in the same stopping pump, leads to overtaxing the air pump for space of time it may work; while, maximum pressure once gained, a total stoppage of pump occurs. Doing work in such a manner, an engineer might just as well be making a 60-mile run on level track, where no stops are required, work steam for a certain distance, and then shut off steam entirely, because maximum speed had been reached, instead of keeping up an even rate of speed by working his engine uniformly over entire distance to be run without stopping.

The pump governor is a contrivance located at a point in steam pipe between the steam throttle of air pump and steam cylinder. All steam for running air pump passes through the governor, and this governor is so arranged and can be adjusted so that when maximum air pressure is reached, the pressure acts on a valve inside the governor that automatically closes steam passage to steam cylinder, and stops its working.

When air pressure falls below maximum pressure, the steam passage is automatically opened, and pump starts to work until again stopped by maximum pressure being reached.

It is good practice to run pump on same principle as though no governor were in use; simply have the governor as a vigilant, to keep pressure from going too high if forgotten.

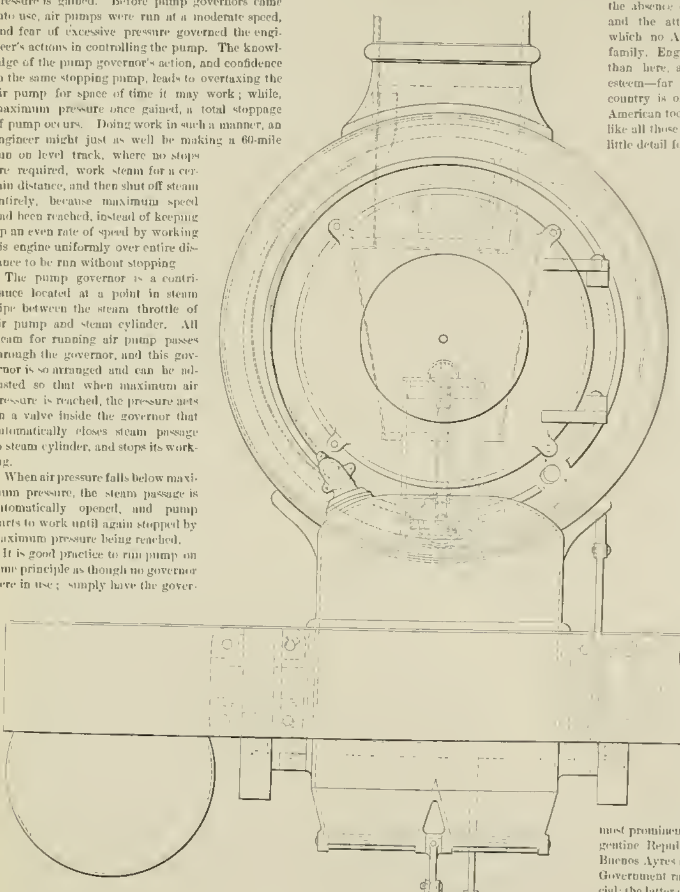
It is not only *poor*, but dangerous practice, to put blind gaskets into joint of waste pipe of governor, in order to secure excessive pressure.

The man who does the best work with the lowest amount of air pressure consistent with safety in an emergency, is the best air-brakeman, and will be a source of unseen profit to a railroad company, in not destroying and sliding wheels.

The man who slid six pairs of steel-tired wheels on one train within the United States, not long ago, making a regular station stop, and turned easy-going Pullmans into rattle-boxes, does not dream of leather medals, yet uncut, for such work. But he deserves one.

Taking the Left-Hand Track.

Several New England roads now run their trains on the left instead of the right-hand track, claiming, and rightly, that the engineers, being thus placed between the two tracks, can see all signals or obstructions better. In Great Britain it is the general practice to run upon the left-hand track, but the reason for so doing is not the same, for most of the locomotives there have the runner on the left side, and one reason given for keeping him there is that he is on the outside, and can see the station platforms better.



Notes on South American Railroads.

BY A FORMER RESIDENT.

South America can best be mechanically considered by dividing it into two distinct parts, Brazil being the first; for here all labor, other than mechanical, has been in direct competition with slaves, wages being very low. The second part consists of Argentine Republic, Uraguay and Paraguay. We will first consider Brazil, and take railroads as a basis for comparing wage rates. The trackman (called section hand in U. S.) receives 800 reis per day, large figures but little money, for it equals about 35 cents when money is not depreciated, and it often is, making the wages even smaller. No houses are provided, as is often the case here on new railroads, and out of his wages must come all the family expenses, consequently food and clothing are of the poorest quality.

Mechanics' wages are about on a par with those of Southern Europe, as everyone knows, very much lower than here, a first-class mechanic rarely receiving two dollars per day.

Comparing the living basis with our own, we first take clothing; the climate allows a light and inexpensive material, but the frequent laundrying, which the climate necessitates, makes the amount as much or more than here for the same quality. The houses are very poor, likewise the food, and the absence of schools makes education a rarity, and the attendant ignorance breeds customs to which no American would care to introduce his family. Engineers, or "drivers," receive less money than here, and are not held in the same high esteem—far from it. The shop practice of the country is on the English plan, although many American tools are to be found. The buildings are like all those erected in tropical climates, with but little detail for the comfort or health of employes.

As we consider railways great, Brazil has none, *i. e.*, no trunk lines, the main railway being owned by the Government, the smaller ones by foreign corporations, mostly English, with a few French. On the Government and French roads the American locomotives are used, the English, however, using their own make.

Passenger equipment is mostly American, modified to suit climate and Brazilian ideas, while the freight rolling stock is mostly English on all the roads.

When we consider the vast territory that composes Brazil, without mechanical means of transportation, except within a few miles of the sea coast, we may say that Brazil has no railroads.

The whole interior is without access to the coast (except to the dwellers along the Amazon and its tributaries), nor are any lines to the interior projected.

The Argentine Republic is so vastly different, and such an advance from her northern neighbor, it may not be out of place to state here that the constitution of this country is modeled after our own, being nearly a copy of it. As all have an equal standing before the law, there is no competition with slave labor, and wages are correspondingly higher, though not equal to our own country for the mechanic or railroader. The railways here are the most extensive of any in South America, and are rapidly increasing, both in numbers and length of road, the largest being built by the Government, and companies of English origin. The most prominent are: Great Southern R. R., of Argentine Republic, the Central Argentine, and the Buenos Ayres and Pacific. There are two classes of Government railways, the National and the Provincial; the latter employ only natives, if possible, while the former make no distinction. The methods of construction will be of interest, as they differ from ours in many ways. The general plan is of English design, and was used in Egypt many years ago. The grading work is similar to ours, though they are far behind in appliances and rapidity.

It is not till the laying of permanent way begins that the American gets fully interested. Wood being scarce in the southern part of the country, cast-iron ties or sleepers are used, "pot sleepers" they call them; they are cast with the top surface like a turtle's back in its oval appearance, and have two lips cast to receive each rail, a steel key with corrugations, corresponding to those in the hole of the sleeper, fastening the rail to its place. The soil of the country is used for ballast, no sand or gravel being available, and tie rods have to be used to hold the ties in position with each other. They ballast as follows, between the tracks, one inch below rail, outside for twenty inches from each rail, level. The flying dust resulting—for the flange of wheel runs in dirt—can be imagined.

In the northern section, wooden ties from a tree called kinbracha are largely used, and make an excellent tie. Spikes cannot be driven into it; a special spike is used, square, with round point. A hole is bored so that the end will just enter, they are then driven home, holding by the corners only. So firmly is this held that the head may be pulled off the spike without starting it. Though so hard, it is very inflammable; a hot coal will eat a hole through it in short order; so the road is ballasted even between the rails, as with the "pot sleeper." The bridges of the country are mostly English, being imported complete; all are of iron.

The depots, or station houses, are mostly of brick, divided for the different class of travel; for, even though a republic, they have first, second, third, and sometimes fourth class. The platforms are a curiosity. A wall is built beside the track, at a proper height from the ground to be convenient for the car steps, and the space behind is filled with earth, in most places, with cement in a few. Ales, wines and liquors are sold at all stations.

The baggage system is after the American plan—a long ways after, too, by the way—but is improving slowly. Their rate per mile is slightly in excess of ours, being about four cents per mile, while the "drivers" receive less than here; first class men receive about $96 when the greenbacks of the country are at par, similar to war times here. The conductors and brakemen are not respected as here, are less independent, and receive less money. Comparing the cost of operating railroads between here and Argentine, the Argentine seems to be less, though coal is ten and fifteen dollars per ton, in gold. But they have no wood in the southern portion, and coal must be had at any cost. In the north, however, wood abounds, and is used there.

There exists in this country a system which is a very fine thing for the men there, for most of the railroad men are natives of either Great Britain or the United States. It might be called the "good behavior and continuous service rewarding system." For every five years of continuous service, in any capacity on the railway, he receives five months' vacation, his wages being continued during the time, and his passage to and from his home, be it in Great Britain or the United States. Engineers, and all above, receive first class passage, mechanics second class, and laborers third class. This promotes a good feeling between the men and management, which is worth many dollars to the corporations. C.

We are in receipt of a note from John C. Thompson, President of the Eames Vacuum Brake Co., in which he calls attention to a suit recently entered against his company by the Westinghouse Air Brake Co., as lessees of the American Brake Co.'s business, for infringement of certain patents on driving brake apparatus. Mr. Thompson offers to furnish guarantee to any and all users to protect them against all suits or claims for damages.

On some of the dirt burners on the D., L. & W., where the engineer is in the middle of the boiler, the steam and air gauges are made to face him, and not the rear of boiler; the cocks and gauges on these engines, with the dome through the cab also, make it impossible for a man to get over the boiler in case of a wreck—a trick the writer has had occasion to perform on several occasions.

The water glass on Pennsylvania engines is protected by a guard, composed of strips of plate glass, held around the water tube by suitable brass corner strips. This arrangement allows the glass to be seen from all sides, prevents cold drafts of air from breaking the glass, and, in case of breakage, flying pieces of glass and hot water do not put their birthmarks on the crew.

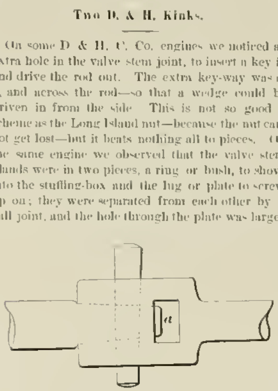
A funnel-shaped cup, of any sheet metal, with a perforated cover depressed into it, makes a clean thing for front trucks. The pipe below the cup should be long enough to bring it up where it can be reached, without drawing a map of oily lines across the frame and wheels.

Jekyll and Hyde Again.

A mechanic who has had considerable buying to do for railroad companies, and was always welcomed, wined and dined by a number of supply houses when he came to town, recently came in to sell something, instead of to buy. He reports a vast difference in his reception, and is hot about it.

Two D. & H. Kinks.

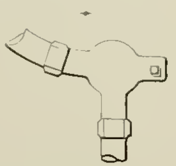
On some D. & H. C. Co. engines we noticed an extra hole in the valve stem joint, to insert a key in and drive the rod out. The extra key-way was at *a*, and across the rod—so that a wedge could be driven in from the side. This is not so good a scheme as the Long Island nut—because the nut cannot get lost—but it beats nothing all to pieces. On the same engine we observed that the valve stem glands were in two pieces, a ring or bush, to shove into the stuffing-box and the lug or plate to screw up on; they were separated from each other by a ball joint, and the hole through the plate was larger



than that in the bushing. This arrangement prevents the cramping of the gland and consequent scoring of the rod.

The new Strong engine, recently built at Hinkley's for the Santa Fe road, has been out on trial on some of the New England roads. The Strong has done some very good work, both as regards speed and weight of trains hauled, but we feel constrained to say that there is no prospect of their superseding our present style of locomotives. They cost more, are more complicated, and carry more weight on trucks than other engines—and trucks do not pull cars.

Some of the writers who give the average life of a locomotive at 30 to 40 years, should remember that the case is like that of an old New Englander who wore a pair of socks forty-two years. His wife renewed the feet one winter and the legs the next, and at the death of the owner they were found "as good as new"—same as the locomotives.



Oil Pipe Holder.

On some D., L. & W. engines they use a fitting like the sketch, to hold oil pipes on side of arch. The fitting is secured to smoke-box by the tap bolt shown, and prevents twisting the pipes in taking down or putting up, and from being cut and jammed by using alligators or pipe wrenches on them. The long oil pipe running under the jacket is a very unsatisfactory and wobbly thing to screw against.

At Renovo, Pa., the extra tenders in the roundhouse yard are protected from the weather by side and back pieces, made of matched flooring, and held on by hooks over top flange of tank. This arrangement is cheap, quickly adjusted, and preserves the paint.

The switchmen held a meeting in Chicago, on Dec. 10th, and declared the "Q" strike off, so far as the switchmen were concerned.

Firing Anthracite Coal.

THIRD PAPER.

The fireman must study the peculiarity of each engine as he is at work on her, and try to fire accordingly. The position of the draft pipe and the size of the exhaust nozzles have a great deal to do with the steaming of a locomotive, and a slight change in either or both makes a vast difference in the manner of firing, necessary to make steam. One instance, which occurred shortly after I began firing, comes to my mind, and may be instructive. I was put on a locomotive which had a bad record, being regarded as a "scrap heap," "not able to make steam," "nor haul a train even if she had steam." I worked on her for nine or ten months with very indifferent success, and did not break her bad record, for, while she would steam some days, the general rule was "no steam," and the "blower" and "injector on," all along the road. I would "clean the fire" from four to seven times in the trip of 100 miles, and shovel from five to seven tons of coal, and still have "no steam." I blamed myself and believed I had "missed my calling," and was assisted to that conclusion by occasional hints from the brakemen about not being "able to keep a cook-stove hot."

But after all these months of "torture," another engineer was put in charge of the locomotive, and on the second day declared "he would try to make her steam," which he did by simply raising the draft pipe ½ of an inch, but, not content with that, he made her do even better yet, by raising it ¾ of an inch more, or 1¼ inches from its original position. After this I could and did sometimes run my fire a round trip of 100 miles "without cleaning," and with steam enough and to spare.

The change in the draft pipe was the only change made, for after a week the former engineer again returned to work; and we thus have the same engineer and fireman on the same locomotive, and she was transformed from the worst to the best steamer on the road, by this simple act. Another fact about her was, that it did not matter how I fired her to make her steam, for if I had time, while at a tank or in a switch, I could put in coal enough for a six or eight mile run, or I could put in a "light fire," and depend upon her getting "hot" and giving me a chance to feed her on the way.

As a rule, it will, however, be found best to carry a fire sufficiently heavy to make a run of six or eight miles, even up grade, with not more than three "feedings," of say three or four scoops of coal, and the hog trough fire as described for the Baldwins, and the "wedge shape" for the others, will generally give the best results.

After a hard coal fire has been used for some time or distance, (of which the fireman in charge must be the judge, because of the different circumstances under which it is used, and the changing quality of the coal,) it becomes necessary "to clean the fire," to get rid of the ashes and clinkers, which are sure to accumulate on the grates, and which, with some kinds of coal, will be found to constitute the greater portion of the contents of the fire-box. To clean the fire, the grate bars before described are pulled out about 3 feet, or dropped aside in the Baldwins. This gives a space of about 3 to 4 inches in width, through which the fireman "knocks out," into the hopper ash-pans, about 2½ to 4 feet of the front end of the fire. If the fire has been heavy and not very much cut up, it is a good policy not to bother with the bars, but to shove them in after finishing the fire. When the fire is light and much cut up, or fine, it is best to replace the bars, after "knocking out the front end." The remainder of the fire is then worked over, to get out all ashes or clinkers, and secure a layer of 3 or 4 inches of live coal over the grates, to serve as kindling for the new coal, which is to be put on top, and furnish the heat for a continuation of the trip. The front two-thirds of the fires are worked over with pokers, averaging about 11 feet in length, while the back end is "barred up" with the corner bar or slash bar about half as long. After putting on a layer 5 or 6 inches thick, the usual practice is to warm it up by the blower, and then put on another layer, to bring it up to the required thickness for the amount of work anticipated. As "cleaning the fire" in a hard coal burner is a matter of time of from 10 to 30 minutes, much owing to the skill of the fireman, or to the improper condition of the fire-box or its adjuncts, it is a job not to be undertaken while the locomotive is using steam, except it be under very favorable circumstances, such as a very light train, or favorable grades, or while drilling or switching out cars. This process of cleaning the fire falls to the lot of the hard coal fireman, from one to six times a day, varying this much on locomotives doing the same work. Much of this (often unnecessary) work is caused by incomplete or imperfect combustion, which may be caused by the quality of the coal furnished, or the imperfect or faulty construction of the petticoat or draft pipe in the front end. The usual style of hard coal burners have been without the extension front end, using a double exhaust nozzle, with a draft pipe leading from the low nozzles to the stack, and having a cone to break up the sparks and a netting to stop the large ones located in the diamond stack. Of late years, however, many hard coal burners are built with extension fronts and straight stacks, and it is believed that they will gradually supplant the diamond stacks altogether.

VULCAN.

New York city is full of reporters, and the New York Central road is handy at 42d street. When one of these roosters wants railroad items he goes up and interviews "the boys," and the engineers invariably fill him up with ghost stories. The latest is the kick about the engine being sulky and mean —because she was tired and wanted to be laid up for a week of rest.

Clinton B. Conger, Mechanical Engineer, Michigan State Ry. Commission, recommends in his report to the commissioner the exclusion from the State of eastern freight cars with heavy dead woods, or bumpers, on each side of the draw heads. He says they are useless in the State, and annually cripple many train men. They are man traps, and should "go"—the sooner the better.

Correspondence.

Long Service.

Editor The Locomotive Engineer:

I am much pleased with your paper. I came here in August to do the repair work on the engines between here and Punta Gorda, seventy-six miles on the Florida Southern. I went an apprentice Oct. 2, 1837, under W. Duff, at Baltimore, Md., was out of my time July 26, '42. I am now sixty-seven years old, have run 1,300,000 miles that I know of, been running steadily since 1840, and still able to run or do a good day's work yet. I am not much grey, and feel young enough to think of marrying again.

Bartow, Fla. JOHN G. ECKMAN.

Like All the Rest.

Editor The Locomotive Engineer:

Enclosed is the amount for renewal of subscription to THE LOCOMOTIVE ENGINEER, which please send to same address until further advised. I am greatly interested in the paper, and think it is doing good in a direction not reached generally by other publications of its class. I wish you success, and my friends in your office a Merry Christmas.

Chicago, Ill. G. W. CUSHING.

Encouragement like the above from such able managers of motive power as G. W. Cushing, shows that the original assumption—that matter of interest to enginemen was of interest to the management—was correct. The enginemen of a railroad are the brains of the locomotives—when there is water on the brain they won't pull cars with any regularity.

About Inventions.

Editor The Locomotive Engineer:

No doubt many of your readers turn eagerly to the article headed "Kinks." We all have a love for kinks, or, as the word seems to indicate, something practical; and these valuable hints, which may have been thoroughly tested by the writers, may also, by being ventilated through your valuable paper, serve to lift some poor toiler over the hill of difficulty.

But while a man may have a large fund of this kind of knowledge, and his hands practiced to all kinds of ingenious devices, yet he may not be a thoroughly successful man; there may be a weak spot somewhere in his make-up, in his younger days he may have spent his leisure hours on the street corners, or in the saloons, when he might have been storing away a fund of useful knowledge, which in after years he could turn into capital in almost any position. I would like to impress these things on the minds of the young readers of your paper. It needs more than a knowledge of how to heave coal, pull a throttle or carry water, to make the locomotive engineers of the future. Intelligence, energy and sobriety will be a winning card every time.

Speaking of inventions, there are so many of the so-called inventions that are only discoveries, the result of certain forces in nature, which by accident arrested the attention of the observer, that may have been the most familiar things; but in a moment an idea flashed through the mind, and we have a discovery, or often mis-called invention. Men often, while seeking for something else, will by accident stumble on the very thing long needed. It is said that a ship worm, boring its way through the wood, and leaving behind it a secretion that gave a hard, smooth finish, suggested to Brunel the idea of the tunnel under the river Thames.

Many other discoveries might be mentioned to show that very trivial things will sometimes result in great and valuable discoveries. I have just been looking at a beautiful engraving of how young James Watt, holding a teaspoon over the spout of the teapot as his parents sat at tea, and seeing the water drop off the spoon, discovered the condensation of steam, which has proved to be one of the greatest discoveries of the century, having revolutionized the merchant marine of the world. So the gold or dross in men will, by some act or word, show itself, and our employers will take us for what we are worth.

Watertown, N. Y. J. J. BINGLEY.

Mistake in Initials.

Editor The Locomotive Engineer:

You are mistaken in saying our road, the D. & H. C. Co., are using two doors over a single opening in Wootten fire-boxes. We use the double-doors placed near corners of fire-box, to let fireman get coal in the corners.

JACOB EITEL,
Carbondale, Pa. R. H. Foreman.

[Item should have read D., L & W.—ED.]

A Typical Heater Test.

Editor The Locomotive Engineer:

In your December number you mention the St. Johnsbury feed-water heater, in connection with the Rushforth heater, giving a thermometer test of the latter. I enclose a thermometer test of the St. Johnsbury heater, also the figures of coal with and without heater; these figures are just as the engineer sent in on his coal tickets, with no expectation of any test.

Temperature of atmosphere, 40° above zero, water in tank, 50°; throttle half open, cutting off at 11 inches, pump $\frac{3}{8}$ open; temperature in heater, 140°; throttle $\frac{7}{8}$ open, cutting off at 17, tem. 200; throttle $\frac{3}{4}$ open; pump wide open, cutting off at 14 inches; temperature, 195°.

On engine number 21 on Boston & Maine Ry., for 10 days in October, with heater, the coal used was 45,500 pounds, ten days with heater off it was 61,500, eight days in November, heater off, used 65,000 pounds of coal, eight days with heater on used but 50,000. Engine was 16x24 cylinder on through freight.

I am a reader of THE LOCOMOTIVE ENGINEER, and agent of the St. Johnsbury Feed-Water Heater Co., and would like to see this test published.

Lyndonville, Vermont. E. C. POTTER.

[This is no test at all; engineers' coal tickets tell no more about the weight of coal than any other guess, and the loads the engine hauled are not given. It is evident that, if heat could be taken from the exhaust to heat the feed water, the engine would run with a larger nozzle, consequently with less back pressure, and save as much or more fuel in this way than by the use of a heater.

When any heater company on earth can prove that, by the use of their device, the average locomotive can save 18,000 pounds of coal every ten days, there will be an immediate demand for 30,000 of them—no road could afford to run a single day without them.

Now, "figures do not lie," but they often get us into scrapes if we quote them recklessly; our correspondent claims that, in the 8-day trial, they saved 15,000 pounds of coal—a saving of within a fraction of 23 per cent.

Now, at 130 pounds' pressure (which would be about 145 absolute) there would be (leaving out fractions) 1,222 heat units per pound, the water is already 50°, so that we want to add 1,172 heat units to the water. At its best he could get but about 212 in heater, and, as the water is 50°, it could be raised by its use but 152°; 152° imparted to the pound of water, would be a saving by use of heater, of but a fraction less than 13 per cent. So that our correspondent claims 10 per cent. of saving more than he can possibly get.]

Teaching a Fireman.

Editor The Locomotive Engineer:

When running a hard coaler a few years ago, I had a fireman who was very hard to teach. I said to him one day, "Jack, I think there is a pound in that front end on your side; you look, and I will handle her for you; when you are ready let me know." I saw him take the monkey wrench when he got down, and thought he was going to let up on the set screw and drive the key, but soon there was a stream of gas out of the fire-box door, and the sound of a voice within, saying: "All right now!" I walked out on the running board, and that man was looking in the smoke-box for the pound.

Fitchburg, Mass. PNEUMATIC.

The Father of Kinks.

Editor The Locomotive Engineer:

Your inquiry about "kinks" received; when you or your readers get to talking about kinks, I just want you to remember that I am the old, original He-kink himself.

I have tried more schemes on locomotives than any other mortal man this side of my late lamented friend Hero, of Alexandria, who passed away something like 2,000 brief summers ago.

He was a real live engineer and genius, was Hero, but when he got up a fountain, or a steam engine, or a drop-forged dart to throw at the enemies of his country, he was content to sit down on his front porch and have fun with the models—never asked for a patent, never yelled "Ereky! Ereky!" or got off his base. A cool, level-headed old runner, was Hero.

Many and many a time have I labored and brought fourth great gobs of thought, and in me thoughts methinks I see a 30-ton hog that rides well; a reverse lever that don't touch a pipe or injector when it gets down in the terminal notch among the oil cans, a door that won't swing shut on crooked track, a time-keeper who don't say "we" can't allow delayed time on account of snow-storms because they are the acts of Providence, and admits that "we" can't control Providence.

I see reachable holes, wherein to oil, and oilable oil to deposit therein, I see schemes that prevent grates from sticking and let me burn 113 per cent. of the fuel and all the smoke with an 11-inch nozzle; I see schemes to make a 42-inch boiler make steam for a pair of 48-inch cylinders, and pop every time you ease her off, but about this far in my dream that tormentor of my life, the fire-boy, roughly informs me that I have run by the tank, and yanks my wandering spirit back from sweet communion with Hero, and Watt, and Stevenson, and Baldwin, and Fontaine, and Swinerton, and Strong, and other congenial spirits.

But I am not always an idle dreamer—sometimes I have the nightmare. I have got up more checks, and gauge cocks and cylinder cocks and throttle latches and spring seats than you ever saw in your abbreviated existence, young man, many more. And where are they now? Ah, there it is, there it is, they are gone, young man, gone like the children whom you fondle on your knee to-day, they go to school to-morrow, the day after they are big enough to wear your clothes, and there is whiskers on 'em, and by Thursday they are gone, gone out into the great, bustling, anxious, itchy world. But in your old heart there is a tender place for 'em, and memories of their little capers fill the niche where they sat in their high chairs, and the ghostly memories of little feet, and soothing syrup, and dirty faces, and doctors' bills loom up before your eyes—and that is the way with my kinks, young man.

Some are here, and some are there, a great many are dead—dead as a smelt—and some have gone out into the world, and multiplied and replenished and made a grandfather of me, and not a few of the handsomest have gone out and married. Everybody wants 'em at first sight, they are captivating; but most of 'em have come home to live; nobody else seems to want 'em very long. But they did not watch 'em grow, and tend 'em, and love 'em, and cultivate 'em, and coax 'em to live, like I did.

Many a time has a new idea come to me while packing my old war-horse in the house, and I have gone off behind the tank to think it out in peace. Then I would give the fire-boy a couple of ten centers to finish my work, and go home with a light, elastic, sort of india-rubber step, and a glad light in me eyes, and call Mrs. A in from the kitchen and the smell of dish-water and stewed onion, and kiss her classic face, and tell her I had got up a patent, and we would soon be rich and I would quit the road, etc., etc. And then she would wipe away a tear with her dish apron and say, "Oh, John, if you could but leave the road." She never seemed to think of anything else, never even asked what the patent was—she was used to it—and then I would get one made, and try it, and decide not to patent it, but give it to the world, and before I hardly realized it, it would be adopted from Halifax to Arkansas, and its name changed—or else it crawled off and died.

But, Mr. Editor, I wander; I have seen your kinks from time to time, and I like to see them and hear of them, just as a proud father loves to hear of valiant deeds of his absent son, or a bang-up match by his absent daughter; for all those kinks are mine, true, some show the marks of their contact with the rude, cold world; some have lost legs, and arms, and ears, and some have gained. Young man, you never heard of a "Kincque" that won't own me as its father. Why, sir, my children have played for years with brass models of all those you have shown up, and many more, many more.

If you want me to, I will spring some of 'em on you; but, mind you, young man, if I go right down into this kink business I can harrow up your young soul, and make 9,000 patentees stand on end like quills upon the fretful porcupine. Shall I do it? Will you give me a regardless order, put out a red flag and take the consequences?

JOHN ALEXANDER.

Pointers Wanted on Driving Spring Practice.

Editor The Locomotive Engineer:

Since we have heard from quite a number regarding the manner, time and cost of handling steam pipes, would it not be a good idea to propound a set of questions regarding the manner of treating driving and engine truck springs, also a description of the various appliances used in roundhouses throughout the country in applying springs to locomotives?

Any information on the above subject would be read with interest by myself, and I am quite satisfied that others would find it equally interesting.

I trust you will give this subject your valuable consideration. E. J. BOUCHARD,

Greenville, Texas. R. H. Foreman.

What is Wrong With This Pump?

Editor The Locomotive Engineer:

I have read many questions and answers concerning air pumps, in THE LOCOMOTIVE ENGINEER, and have a question to ask; am in need of information. I am called a machinist, but do not think myself worthy of the title. Some few days ago I tackled my first air pump, to give her a general fitting up; I cleaned all the working parts and steam passages, set discharge and receiving valves $\frac{1}{16}$" lift each. The steam pump and parts seemed to be worn very little, and needed nothing that I could see. I put pump together, and in position on engine (the only testing process we have), steamed engine to 110 lbs., but the pump would only work when tapped hard on upper cylinder head, and stop at the end of down stroke, and sometimes would go up before a full stroke was made, and I am stuck fast on my first pump. Can your air pump correspondents tell me the cause, and how to remedy it, and oblige a patient subscriber?

Cuero, Texas. SNOOKS.

Feed-Water Heater Tests.

Editor The Locomotive Engineer:

In your last issue a correspondent comments on tests I made of a Rushforth feed-water heater, and you editorially assume that I was ignorant of the peculiarity in the construction of the heater, which makes the water in the boiler circulate through the coil. You are mistaken there. As part of the test, I made them dump the fire of the locomotive and ascertain the temperature of the feed water, with the smoke-box cold. With 140 pounds' steam pressure the feed-water temperature was about 160 degrees, so I concluded that the estimate made of heat saved was near enough for all practical purposes.

I very much doubt the soundness of your dictum, "there is no waste heat in the front end of a locomotive." With a smoke-box temperature of 800 degrees Fah. and upwards, which is quite common, it looks as if there was an unnecessarily high jump above the temperature, inside the boiler, of 360 degrees Fah. and under. After the gases of combustion have emerged from the flues, their heat is of no more use for steam-making purposes; when a forced draft is employed, and if it can be utilized in any way, the whole of the heat saved must be gain. That is a dictum which I think few steam engineers will question. ANGUS SINCLAIR,

Editor National Car and Locomotive Builder.

He Wants Lights—13 of Them.

Editor The Locomotive Engineer:

Will you kindly tell me the following in your valuable journal, in as plain words as possible:

(1) What position should engine be in when front end main rods are taken up? (2) What position when back end main rods are taken up? If they are taken up when they are on $\frac{1}{4}$ or $\frac{1}{8}$, is there not a great deal more danger of a green hand at the business taking them either too short or too long? Is the plainest and surest way to (for back end) caliper pin with outside calipers, and then caliper brass with inside calipers, and find out how much is to come off of brass—divide it so as to find out how much is to come off of each half? Say brass is $\frac{1}{4}$ inch more than pin on its centers, take off $\frac{1}{8}$ of each half. Then file back 1 inch on top of each half, top and bottom say about $\frac{1}{16}$ off. Put brass in strap and key it up, and if it can be turned all around freely, it is right. To shorten rod, put liners in between strap and brass, and to lengthen, put in between end of rod and brass. That is my idea—but have never had rods to take up.

(3) Will side and main rods both knock while passing dead centers and working steam, or only main rods? (4) Please give me plain directions how to always tell a piston from a valve blow, without taking off cylinder head. (5) How is best and surest way to bring engine to shops with a broken front driving-box—when it is broken clear through from top to the journal—without cutting journal? (6) How is it some engines will bear "rawhiding" or "gouging," and steam well, and others will not? (7) There is considerable talk here of one of our engineers working engine throttle wide open and hooked high. Is not that the best way to work an engine? If not, why not? Does heavy steam pressure on valves (downward), when wide open, have any bad effect? If so, please explain it. (8) If you are running an engine ahead, and back eccentric strap breaks, can you, by taking down that strap *only*, run on (forward) without further danger of breaking any more of them? (9) What is a sure plan of always telling which eccentric has slipped, and best and quickest way of setting them? Sometimes they have slipped so little it cannot well be told by examining them, and they are so tight you cannot tell by feeling them. (10) How is a valve stem clamped when putting engine on one side when metallic packing is used? (11) I was on a passenger engine recently, and when air brakes were applied, pump would not pump enough air to release brakes for several minutes—both stuffing-boxes of donkey were leaking very bad. Was that the cause? (12) Why is the steam gauge pipe always bent? (13) What will a valve model for lodge-room cost? I mean a nice one. Where can it be bought? Why don't some manufacturers of such advertise them in your largely circulated journal? It seems strange to me that publishers of machinist and locomotive engineers' books, manufacturers of engineers' torches, pipe wrenches and steel pocket graduating rules do not advertise them in your paper. J. O'CONNOR.

Birmingham, Ala.

[(1) On the down quarter—because the crosshead pin is not round after worn, the most wear being when the engine is leaving the centers, and the least from where the exhaust takes place to the next center. They should be keyed on the largest part of pin, to prevent heating, the top quarter is as good, except that front key is generally harder to get at. (2) On the engine center (when the crosshead is at end of stroke)—because the main pin is flat where it receives thrust and pull of piston, and is largest where least work is put upon it, at the center; if keyed on the quarter or eighth, you could close the brass on an old pin so that it could not pass the centers. Main rod brasses should not be worked on very much without measuring the stroke, and striking points, and dividing the clearance. In filing brasses, care should be taken to keep the outside fit, in the strap, good, and both brasses in line. Brasses should be keyed in the strap and fitted to the pin on the center, and should be free at that point. You shorten or lengthen the rod correctly. (3) It is claimed by most men that side rods (on 8 wheelers) will not pound, but they do rattle and slap very hard, and a side rod with a knuckle-joint in it, will pound, and pound hard. (4) A piston blows at intervals, as it receives steam, a valve blow is usually more constant. If you place engine you suspect on the quarter, the reverse lever in the center, and open the cylinder cocks and throttle, a blow out of either cock will come from the valve. If you block the engine at the quarter, and give her steam with reverse lever in corner, a piston leak will show at both cylinder cocks, and also blow through the nozzle. It is very easy to distinguish a blow by the way it blows. (5) Anything that will relieve the weight, or lessen the speed, will reduce the tendency to cut. The easiest way is to run the engine light and slow, and oil often. An easy way to relieve weight is to block up equalizer and relieve or remove spring over broken box. (6) Switching with road engine is what we always called rawhiding. Do not know why one engine should not steam as well as another under the same treatment. (7) A wide-open throttle, and as short a cut-off as will do the work, is the theoretically proper method; there are many cases, however, where controlling speed and work by the throttle is necessary, especially engines that have very few notches in the quadrant.

The writer is free to confess that he has tried the full throttle and hooked-up plan hundreds of times, and with all kinds of trains, but has met with more failures than the opposite; in nine cases out of ten we have found a place both for lever and throttle, where the engine did better in every way, and it "seemed right."

The load on a slide valve is enormous, but wire-drawing the steam relieves it but a little, and at the expense of the pressure on the pistons—where all the work is done. (8) No, take down both straps. (9) The best way to tell when an eccentric is slipped is to have them marked, a good way to mark them is to place the engine at some one point, say the forward center on right side, and mark across all the *straps* and eccentrics—these marks are easier seen than those on the axle, if anything is wrong with your exhaust, place engine on this center and examine your marks; if three of them are all right the one that is off is the one that needs bringing back to the mark; if they are right, look elsewhere for your trouble. (10) See answer to Question 34 in June number. (11) Probably leak prevented pump from accumulating air fast, and air pressure had been reduced unnecessarily low by improper manipulation. (12) To form a trap to retain water, direct, dry steam overheats, and destroys the tension of gauge tubes and diaphragms. (13) Extra fine valve model is worth about $200.]

From the Land of the Sacred Crocodile.

Editor The Locomotive Engineer:

Papers went all over the country before they got to me, on account of your spelling Sohagpur, S-o-h-a-l-p-u-r, and many have gone astray. I enclose my address in full.

I find American papers are far superior to English ones, and they are cheaper, and the postage less.

I shall soon send you photos of some of our engines, they were made in England and Scotland; I could also send you photos of ancient temples, etc., as I am something of an amateur photographer. I commenced work as a railway apprentice at the shops of the Great Western Ry., at Swindon, in 1856—thirty-two years ago—consequently I am not a young man; yet all work appertaining to railways is still my hobby.

I have been twenty-one years on this road, the Great Indian Peninsular Ry., seven years as an engineman and fourteen as a foreman.

FRED. W. BEDFORD.

Sohagpur, C. P., East India.

Solid Bushings in Side Rods.

Editor The Locomotive Engineer:

I have watched with considerable interest the advent of the solid bushing, and have taken some pains to find out the opinions of different engineers as to its merits. Their opinions differ widely. It reminds one of the days when the parallel driving box shoe began to displace the tapering wedge on the front jaw. It was no uncommon expression to hear an engineer say, "How can a man keep his engine in tram without adjustable wedges all around?" But the shoe has evidently come to stay, and many a man has learned that an engine once put up with driving axles square across the frame will stay so, much better with the shoe than with the wedge. He has come to learn that the less he tinkers with the lining and squaring of rods and axles, the better his engine will run. Of course there are exceptions—as in case of inferior workmanship, etc.

The rod bushing has the same prejudice to overcome, but it seems to be getting there all the same. It makes its mileage right along, and don't get hot about it very often, certainly not as often as its ancestor, the loose brass—which is well named, for it was more often loose than otherwise—and when loose we all know how fast it will file itself, the key, and the strap, also how the loose liners will cut into the strap, especially if they are a little short up and down. What can be more un-mechanical than to take down a rod, and have a half-dozen liners spill out on the floor?

In comparison, how much neater and simpler the solid end looks than the strap end.

Compare the vast difference in first cost between the two styles in favor of the former. Note the difference in cost of maintenance in favor of the bushing.

A solid bushing, if properly put up and broken in, should run from six months to a year before being renewed, and in all that time you have not had to turn a set screw, drive a key, or tighten a bolt, and when worn so as to rattle too much, they can be renewed all around, and not lose more than a trip or two, and when the job is done the side motion is also taken up, which is not the case with keyed brasses.

I understand that some roads are adopting them for main rods, as well as for side rods.

I have an engine in my charge that has bushings in front end of main rods, and the ones put in by the builders ran for four years before being renewed.

Yes, bushings are a hobby with me.

Pueblo, Col. HIRAM R. JONES.

Using Slack—A Peculiar Engineer.

Editor The Locomotive Engineer:

I was much pleased with the letter from that fireman in Florida, and thought I would tell you a little about the peculiarities of my bold engineer. We haul long, heavy trains here, and my right hand partner never can start without taking the slack, and, although the slack of 15 cars will start any train, he is never satisfied with less than all—slacks back till he sees the caboose hob. I suppose if he wanted a vent in a barrel he would make it with a two-inch auger. Often when almost stopped he will pull the engine over and take up all the slack as she stops, and always leaves lever back while he oils around, etc. He is afraid his fireman will learn to be an engineer, he never lets me handle her at all. He don't take your paper, because he says railroad papers are nothing but love stories and lies. He is a crank on manners, and objects to his fireman flirting or waving his hand to the girls along the road, and will lay down his pipe if he sees a lady on the depot platform, and won't go into an eating house without taking off his over clothes and washing his face. He makes life a burden for me by his old maid actions. He don't say much—that's one good thing about him.

Indianapolis, Ind. FIREMAN.

[We should judge that you have been firing about six months—that is about the time a fireman thinks he knows more than the master mechanic—and will venture to say don't know half as much about your own duties as you think you do of your engineer's. From your own testimony, you must have a good engineer, he knows how to start a train, at least, and we will warrant does not break it in two, as he would if he slacked a few cars and used the rest as a dead weight to jerk against, as he works it he only starts one car at a time. You will probably get a chance to switch once in a while after you know enough to fire, and the swelling in your head goes down.

Your engineer is justified in his estimate of railroad papers if he has never tried but one; that he is a gentleman, and wants you to be one, and you are not, is to his credit and to your discredit. Keep your eye on that runner, he is a good one.]

About Burning Engines—Some Notes from an Old Timer. Boilers that Split their Water.

Editor The Locomotive Engineer:

Permit a word, if you please, from a reader. It does an old 'un heaps of good to read THE LOCOMOTIVE ENGINEER, if even at intervals of a month, and especially a fellow who has not been on the foot board, except for fun, for over twenty years, but one who loves to read of the successes of the boys, and sympathizes with them in their mishaps and disasters.

I would not dare approach you with this scrawl, only to offer a suggestion to a very useful man, who, however well he may be adapted to his present calling, in our opinion, might do better, and not suffer so much as he will this winter whilst plowing snow and trying to keep his pumps open, and the old mill alive.

There is not probably as much solid science in John Alexander's communications as in some others of your correspondents, but for downright solid laugh, give us John. My friend, your subscriber, Mr. G. P. Mowry and myself look for John sure, and are seriously disappointed when he ain't on deck. But our suggestion emanates from Mr. Mowry after reading John's Ideal Overclothes, and is warmly seconded by me, I am personally acquainted with Mr. Geo. W. Peck, of *Peck's Sun*, Milwaukee, and see the necessity of an infusion of fresh blood into the *Sun*, as, since the Bad Boy left the *Sun* office, it has never shone with its wonted luster.

Now, just tell John to run in the old mill, and leave her between two good coal stoves in the roundhouse, and come up to Midway, Wis., we will give him a letter to Bro. Peck that will make him associate editor of Peck's *Sun* instanter, and we will subscribe for fifty copies.

I dare not touch the more intricate subjects treated of in THE LOCOMOTIVE ENGINEER, knowing how lightly the old fellows who love to hear the click of the pump valves, and who never handled a Westinghouse air brake, a Hancock inspirator or a Monitor injector are esteemed by their modern brethren who are so thoroughly posted on all the kinks. Yet, methinks, some of the old fellows might get over the road yet without much trouble, after learning the names of the improvements.

Your article on "Burning an Engine" is a good one, and, whilst I am not an advocate of burning an engine, nor ever did burn one, yet I do know how easily it could be done; and as I am sure that many of your readers will call your engineer of the Bee, No. 82, a fool for being ready to swear that he had three gauges of water, for your and their benefit I will relate a little incident in my own experience, corroborated by two other good men.

In the year '59 or '60, I am not sure which, I was on an extra engine for one or two trips, whilst some temporary repairs were being done on my regular engine, and was then running for the Memphis & Ohio Ry. Co., from Memphis, Tenn. to Paris, Tenn., the engine was the Rogers engine "Frazier Titus," M. M. James A. Long. Our water was a little inclined to foam in West Tenn., and we had to be very careful, but my engine showed three gauges and was running with very light pump-feed. She was steaming well and doing good work, yet her water kept up—solid water, but it kept up almost too well, so that I began to doubt her veracity, and tried the second or middle gauge cock, the water was broken, the top cock solid, the third or lower cock *blue steam*. I shut her off immediately, and when the water settled, had just a flutter in the lower cock. Well, although not a very young runner at the time, and not generally considered a fool by my fellows, yet I dare not tell of the circumstances, for fear of being considered a fool or a liar; but inside of two weeks from that time, a very intimate friend of mine, whose engine went into the shop when mine came out, was running the same engine, the F. Titus, on the same train, and as we sat in the evening, after supper, I noticed Mr. Duncan Andrews in a deep study. I asked him what was troubling him, and he tried to evade a direct answer, but, being intimate, I pressed him kindly to tell me why he was so deeply lost to his surroundings. His answer was that he did not want to tell me, lest I should think him a fool, but I still pressed him closer, when he asked me if I had ever seen an engine working well and show solid water in the top cock and blue steam in the lower one. I told him I had, he was surprised, and said that he was afraid to mention the circumstance for fear no one would believe him. He then described the trick the Titus had tried to play on him. It was just a repetition of my own experience with her, and on the same grade and same train. We kept the matter to ourselves, and did not talk it much, lest it might get out, and both of us be considered cranks.

In 1861, immediately after the fall of Fort Sumter, I quietly closed up my business at Huntsville, Ala., by putting my engine into her stall and getting my time from Mr. James Crawford, M. M., and W. A. Purse, ex-locomotive engineer, acting as head clerk in the M. M.'s office, and came up to this country, where I went to work on the 20th day of May, 1861, for what is now known as the C., M. & St. P. Ry. Co., but was then the Lacrosse & Milwaukee R. R., C. L. Rice, M. M. I think it was in 1862 or 1863 that Mr. Chas. Morse (who was on the road when I came, and afterwards went back on the C., B. & Q., where he came from) was running the Rogers engine No. 26 on the western div., from Portage City to Lacrosse, I was running No. 27, a fac-simile of 26, on the opposite run, but Charley and I got together one Sunday, and he was very much interested and looked a little worried about something, finally he told me that he would like to ask me a question, if I would promise not to laugh at him and consider him a fool. I promised, and he related what No. 26 had done for him yesterday on Round Bluff, and asked me if I had ever heard of such a thing before. I told him of my own experience and Duncan Andrews' with the Titus, another Rogers, and it relieved him.

Now, whether any of your readers have ever had a similar experience, I would like to know through THE LOCOMOTIVE ENGINEER, and therefore, I think, under similar circumstances, it would be an easy matter for even a good man to burn an engine, but I would hate the record. And whilst the hydraulic man may be the worst runner, and may as effectually produce death to the engine by consumption as the other fellow by lightning, yet two wrongs do not make a right, and I am still convinced that nature makes the engineer, and practice and education equip some of them. But all the practice and all the education a blockhead may get cannot make a first-class man, and I think there is yet room at the top.

Midway, Wis. T. B. LIVINGSTON.

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CONTENTS.

Our New Dress.

THE LOCOMOTIVE ENGINEER is a year old, and has been put into short clothes. As will be noted our new type is brevier instead of long-primer—two sizes smaller. This gives us more meat in the same shell. The same matter that would, with the old type, have occupied three columns, will occupy but two in the new; so that in 12 pages we gain four. We propose to give three or more of this gain to the readers, and use the other for advertising, and in some instances, as in the present number, the advertisements may come over upon the 11th page; but, as we will be giving three for one, think all will be satisfied.

We also change the editorial page from the 10th to the 8th page, which appears to us a neater arrangement typographically.

About Federation.

The Engineers' Brotherhood, at their recent convention in Richmond, declined to accept any of the plans of federation proposed. After mature deliberation we are of the opinion that this is best. The railroad orders should adopt rules of non-interference in case of trouble, but it would be a herculean feat to unite all the interests and keep them united. The Engineers' and Firemen's Brotherhoods have interests that are identical, yet the engineers have been unduly jealous, and distrustful of their juniors. The late trouble on the C., B. & Q. has proven that these fears were entirely groundless. When the engineers meet next year at Denver, we hope to see some of the men who have been talking and writing about "the twin brotherhoods" get up and offer an amendment to the constitution, abolishing that close-communion, barbarian clause requiring a young engineer to withdraw from the Firemen's Brotherhood before he can join the engineers. This might be federation and it might not—it would be right, anyway.

A Hero in Overalls.

At 4 A. M. on Dec. 18, a light engine, running ahead of the Texas Express, on the St. L. & S. F., ran into an open switch near Springfield, Mo., making a fearful wreck of itself, and disabling the engineer and breaking the fireman's leg at the ankle.

The switch rails had been moved by train wreckers, expecting to ditch the express. The fireman, disregarding the agonies he suffered from his broken leg, dragged himself back on the track for a mile, flagged and stopped the express with 200 passengers on board. If this were time of war, such deeds of sacrifice to duty and humanity would win for the man who suffered, but shirked not his duty, the love of a nation, and shoulder-straps of promotion and honor. This man saved 200 people from the horrors of a fearful wreck, and his employers from a great loss of property and damages, and if the "'Frisco" route follows the practice of other roads in similar cases, they will quibble about allowing him half pay for the time he is laid up, and refuse to pay his doctor's bill outright.

It is this very devotion to duty in small as well as great emergencies, that surrounds the American traveling public with a safeguard that money cannot produce—and it deserves recognition and remuneration something nearer its value than it gets.

We regret that we did not learn the name of this young hero of the scoop.

Putting Motive Power into the Hands of Transportation Department.

The Erie road has made a new departure in putting, not only the engineers and firemen, but the shops and all other employes of the motive power department, under the immediate charge of the division superintendents.

Such a move is obviously a last resort—a sort of death struggle.

The division superintendent can no doubt get more service out of the engines, for far less money —as long as the power lasts—then they are done.

When a road commences to drop out master mechanics, and run the power for all it is worth with no responsible mechanic to look after its maintenance, it is high time for the thoughtful public to take some other route, and stockholders would save money if they secured a receiver at once.

Managements that resort to such measures *to make a show* always point to the Pennsylvania as an example of superintendents' management of motive power. The Pennsylvania does put all the enginemen under the transportation department, but they are careful to have the best of shops and systems, under the best of mechanics, to furnish engines for their use, and no man has a regular engine; they are all of certain standard designs, and kept in the best of repair.

With the Erie's numerous classes and builds of scrap heaps, no heads to the mechanical departments, and the shops under the division superintendents, the paralyzation of its motive power will be only a matter of time—and short time at that.

Promotion of J. E. Phelan.

It is with pleasure that we record the promotion of one of the progressive young enginemen of the country, J. E. Phelan.

Mr. Phelan is well known to the readers of this paper, as the author of the series of articles on Modern Air Brake Practice, now running. These articles are the first of their kind that have appeared from a practical engineer, and have attracted attention far and near.

J. E. Phelan commenced firing in 1873, at the age of 16, and handled a scoop a little over seven years. Always a close observer and a student of his business, he passed rapidly from freight to passenger engineer, when once promoted, and then to traveling engineer, and for some time past has been general road foreman of engines of the whole Northern Pacific system, from the Father of Waters to the Pacific.

On the first of December he was appointed master mechanic at Mandan, D. T., with new shops, new offices, a fine equipment of locomotives, and a class of enginemen of his own selection—a responsible and important position for a man of 31.

J. E. Phelan does not owe his position to family or friends; he has gone steadily on through changes of administration—because he tried. Nor has he gone as far as he will, if he pursues his former habits of study, observation, and the widespread instruction of his fellow enginemen; some road will want him to write Sup't M. P. behind his name—because it would pay them to do so.

We are not given to the habit of remanding men who are hard at work that they can be president, senator, master mechanic or even engineer, if they will do as George Washington, or General Grant, or John Smith did, but every man on a locomotive in this country can cite this case and rest assured that it is always the man who fits himself for promotion who keeps it when he gets it, and the man who don't think and don't study, don't get it.

Attempt to Burn Pea Coal on the Elevated Road.

In last month's paper we called attention to the fact that there was an attempt being made to burn pea coal on the elevated road, engine 93 being used to conduct the test.

Through the courtesy of General Manager Hain, the writer was enabled to ride on this engine and see how she did with the cheap coal.

We made two trips over the road, with different engineers, both on light, 4-car runs, and saw enough to convince us that the "L" will not make a fortune by using pea coal this winter. The engineers and firemen tried hard and faithfully to get steam with it, but it was no go.

The elevated engines have to start and stop every fifth block, and the engines are, as a rule, worked pretty hard for two or three blocks and then shut off; this treatment tears the light fire of small coal all full of holes, and then lets it die. In no instance in two trips did the throttle go shut before the blower was singing its little song; the engineers favored the engines in several cases to one gauge of water, and the steam was oftener at 90 to 100 than at 135, the blowing-off point; in one case it fell to 85 pounds.

At both ends of the run, Third avenue, time 30 minutes, the grates were one solid clinker. This road has a very poor chance to clean fires, and there are strict orders against it at the City Hall station; yet this had to be done, or the engines would have died. The Manhattan had one Wootten fire-box, but it was not a success—had to clean fires too often—and there is no hope of using wide fire-boxes above the frame, as the engines are limited as to weight by the superstructure, the engines now in use weighing 46,000 pounds.

The Manhattan Elevated road carries more than half a million of people daily, and it was a mighty mean Wall street spirit that prompted the desire to burn dirt for a slight saving in fuel, to the discomfort and delay, if not actual danger, of this half million people. The end came in a few days, several engines were out with dust, and they laid down between stations. At first the passengers good-naturedly walked to the next station, but on Saturday, the 15th of December, several train loads refused to walk, and the engines that were having Wall street chills were pushed in by engines burning coal. The remarkable freedom from fatal accidents on this road, carrying, as it does, the largest passenger traffic in the world, has been due in the past to excellent management, well-maintained power, and painstaking enginemen; but if the greed for dividends is allowed to step in, the patrons of the road must look out for disasters. When burning pea coal, both men were worrying over, and working at, their fire, and, as a consequence, neglecting their outlook, signals and track.

With the lives they handle, the "L" roads should pay, if necessary, extra high prices for extra good coal, to enable the engines to get over the road without possible delay on account of steam, instead of jeopardizing 500,000 lives daily to save a few dollars per month on fuel.

A Dangerous Practice.

The Erie, following in the wake of other roads similarly mismanaged, has made a deep cut in the motive power department, to help out the management and the dividends for the hard-working gamblers who own its watery stock in Wall street.

Cutting down expense at the risk of decreasing the safety of its motive power, is the worst form of railroad suicide. It invites wreck and ruin, and it uses up all the available power, so that in better times the road is short-handed, and can only do a fair amount of business by buying new power outright.

Any man that knows anything about it knows that such relief is only temporary, and the reaction doubly severe.

If the Erie is going to do any business, the repairs to her motive power and rolling stock must be kept up.

Another thing, good men do not have to work for half-pay, while other roads want good men at full pay, so that what help they do keep is the poorest. Mr. J. H. Vreeland, M. M. at Jersey City, resigned rather than stand a reduction in his department below the safety line, although he has been with the company 23 years. Mr. Vreeland has a wide experience as a master mechanic, and is not only thoroughly up in locomotive maintenance, but has had charge of the machinery of the ferry, tug, and harbor transfer boats of the company. Some road that does not expect to run the machinery department, with the pop screwed down, and no water in the lower gauge, will want him and his experience, and the Erie will have lost an advantage, and the other road have gained.

Discussion on the Contracting Chill for Cast Wheels.

At the regular meeting of the N. Y. Ry. Club held on the evening of Dec., 20, Mr. J. N. Barr, Supt. M. P. of the C. M. & St. P., read an able paper on the improvement of cast wheels by the use of a contracting chill, and described his chill and its action.

Mr. Barr's chill is surrounded with a hollow rim, into which he introduces steam before the wheel is poured, thus expanding the chill, then, as the wheel is poured, the steam is replaced by a stream of cold water, this contracts the chill and keeps it in contact with the wheel longer—producing a deeper and more even chill.

Mr. Whitney showed photographs of the chill used in his works; this chill has internal segments like Mr Barr's, but the expansion of the metal in these segments, causing the chill to reduce its size—or contract—is brought about by the absorption of heat from the wheel itself.

There was a pretty lively criticism from wheel makers who do not use contracting chills, but we believe the greater majority of the mechanical men who attended the meeting went away convinced that there was merit in the plan. We regretted to see no one there to represent the claims of L. R. Faught, of Phila., for recognition as the inventor of this great improvment in the mechanic arts.

Mr Barr is the inventor of the chill that is expanded, before pouring, by the application of heat. Mr. Whitney has made contracting chills cheap and efficient by the invention of a process of dividing the segments of the chill in casting—making a clean cut through two inches of solid iron, but $\frac{1}{100}$ of an inch wide; in itself a great invention.

But Mr. Faught invented the contracting chill, he is the father of the idea of making the expansion of the metal in the chill go *toward* the wheel, instead of *from* it.

The inventions of any and all these gentlemen are of service to mankind in the production of cheaper, better, and safer rolling stock, but of the trio Mr. Faught is the central figure, on whose fundamental principle the others have built and improved. His invention dates back to 1876, and his patents nearly as far. Mr. Faught is to the contracting chill, what Howe was to the sewing machine, Whitney to the cotton gin, Ericsson to the screw propeller, and Jethro Wood to the common plow—the pioneer.

The discussion on standard axle for 60,000 pound cars was not discussed very freely, and the subject was held over for the January meeting. There is much to be learned in the discussion of practical questions in such meetings, and railroad men should interest themselves in the meetings—we mean real railroad men, enginemen, car hands etc.; information gained here would tend to make you able to advance from your present positions—and stay advanced.

We noticed at the Long Island shops, several Richardson balance valves that had the small relief hole in top closed up to about $\frac{1}{8}$ of an inch. The original is $\frac{1}{2}$ or $\frac{3}{4}$ of an inch in diameter, and is always provided to let any steam that might leak past the packing strips out into the exhaust. When a balance strip is broken or comes out it is hard work to get the engines to pull their trains with the big hole "bleeding" the steam away. The small hole does just as well for the relief. Accidents to the packing strip are very rare, but no device is "perfectly perfect."

L. S. Allison, manufacturer of mining machinery, Hazleton, Pa., is fitting up extensive branch works at Minersville, Pa., and will make a leading specialty of building mine locomotives.

Books Received.

THE CORNELL UNIVERSITY REGISTER, 1888–9.

This is the book issued yearly by Cornell University, which embraces Sibley College of Mechanical Engineering and Mechanic Arts.

"This college was founded and endowed by the liberal gifts of the late Hon. Hiram Sibley, of Rochester, who, in the year 1870, gave about thirty thousand dollars for the erection of a suitable building for the Department of Mechanic Arts. He also gave ten thousand dollars for increasing its equipment of tools, machines, etc., and afterward made a further gift of fifty thousand dollars for the endowment of the Sibley professorship of practical mechanics and machine construction. During the years 1883 to 1887 he gave more than seventy five thousand dollars for the purchase of models, the extension of the Sibley College buildings, and the building and equipping of a complete set of workshops. The total amount thus presented to Cornell University is nearly one hundred and fifty thousand dollars. The college is divided into three principal departments: that of Mechanical Engineering, including a laboratory, in which experimental work and investigations are conducted; a department of Mechanic Arts or shopwork, and a department of Drawing and Machine Design."

This college has an excellent reputation as an institution of learning for mechanics, and young men contemplating study and improvement in mechanical engineering should send to the University, Ithaca, N. Y., for this book, which is furnished free.

ASKED & ANSWERED.

(1) W. M. E., Leavenworth, Kan., asks:

Do you know of any kind of metallic packing that can be used in packing pistons that have the old style gland—I mean used without turning out stuffing-box or making face plate or cone to fit? *A.*—There are several makers of coned lead rings for pistons to use in common stuffing-box, but we do not know where they are.

(2) H. H., Benzinger, Pa., asks:

Will a locomotive with all its weight on four drivers pull as much as the same locomotive on eight drivers, provided she has a flexible wheel base? *A.*—Theoretically, the number of drivers will make no difference, adhesion is governed by the load, regardless of the number of points of contact. If the engine has weight enough to prevent slipping she ought to pull more with four than with eight wheels; there would be less friction.

(3) T. H. L., Toyah, Texas, asks:

How do they measure curves on railroads by degrees? What is meant by a 17° curve? *A.*—Surveyors measure curves in degrees, by assuming the curve to be a part of a circle so many feet radius, or the distance from the center to the outside of circle, and counting a 1° curve as having a radius of 5,730 feet, a 2° curve having half as much, or 2,865, a 3° curve one third as much, or 1,910, and so on, each degree representing a proportionate fraction of 5,730. A 17° curve would represent part of a circle of 337 feet radius.

(4) Ouray, Gunnison, Col., writes:

We have heavy, consolidation, narrow gauge locomotives here, with main pin on the second pair of drivers. In starting a heavy train, these engines roll or rock a great deal, and you can increase the rocking on the start by hooking them up about half way; after the train gets to going four or five miles per hour this rolling motion stops; why do they rock? *A.*—Probably the roll is caused

Fig. 1

almost entirely by the angularity of the rod; the center of cylinder is above the center of the driving wheels, and the rod is very short, when it is passing the lower quarter, as in Fig. 1, it allows a more or less direct lift against the

Fig. 2

cylinder, frame and boiler, and the fact that the center of gravity is high and the frame narrow lets it cant the weight over onto the springs of the opposite side, these are compressed, and then help the crank on that side to throw

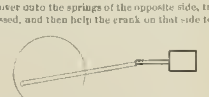


Fig. 3

the boiler back as soon as it gets into the position of Fig. 2, and the side that threw it over that way gets at or near position in Fig. 3, and lets go; over the top half of the stroke the angularity is not so great, nor in position to

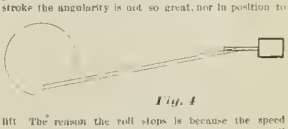


Fig. 4

lift. The reason the roll stops is because the speed increases, so that the engine does not have time to roll between the pulsations or lift. An engine with a long connecting rod, like Fig. 4, will not roll so, as it has not the angularity to the rod. A low center of gravity or a wider frame would also tend to diminish it.

(5) W. L. S., Emporium, Pa., asks:

Will a chilled tire adhere to a rail and pull as much load as a steel tire? If any difference, how much? *A.*—Assuming that the writer means tire for locomotives, we would say that chilled tires were used to a considerable extent before the introduction of steel, and they did fairly well. At that time they ran on soft iron rails, and many mechanics claim that chilled tire would slip easier on a steel rail than steel tire. The writer has seen cars alike in every other way, except the wheels, some having cast-iron wheels with chilled tire and others paper wheels with steel tire, and the brakes would slide, one as soon as the other, with same air pressure. We do not know of any chilled driving tire now running. The difference in work done would not be very much, but the safety, ease of repairing, and turning would be greatly in favor of the steel.

Locomotives and Railroads from 1800 to 1888 in America.

By William Barnet Le Van.

FIRST PAPER.

Railroads are an ancient institution, and locomotives are the outgrowth of a machine invented to run on them.

Many relations of ancient history are sufficient to prove that the principle of the railroad was not unknown at a very early period. We read of the transportation of heavy masses—stone for the pyramids of Egypt—heavy carriages, warlike machines, and baggage, across marshes and swamps which could not be passed, until artificial roads had been first contrived. In after ages, at the memorable siege of Constantinople, the genius of Mahomet conceived a plan for transporting his light vessels from the Bosphorus into the shallow water of the harbor "A leveling " says Gibbon, " was covered with a broad platform of strong and solid planks, and to render them more slippery and smooth, they were anointed with the fat of sheep and oxen. Fourscore light galleys and brigantines, of fifty and thirty oars, were disembarked on the Bosphorus shore, arranged successively on rollers, and drawn forward by the power of men and pulleys."

Railroads were probably invented by the ancient Egyptians—their origin can be traced to a period of the most remote antiquity Railroads, composed entirely of massive blocks of smooth stone, and adapted to the passage of wheeled carriages, are still in existence in the vicinity of the quarries whence the stupendous stones were extracted which were used in the construction of the pyramids These roads have been incidentally mentioned by the French and Italian *savants* who have visited that cradle of the arts; but none of them have hitherto imagined that they were, in fact, railroads. Their preservation for three thousand years, notwithstanding their exposure to the assaults of time, the havoc of wars, and ravages of barbarians, is remarkable, whilst every vestige of the numerous canals which were constructed by the Ptolemies, or Caliphs, in Egypt, has long since been obliterated from the face of the earth. In Palmyra and Balbec, similar railroads still exist; and in Cyrene, in Africa, long lines of such railroads, composed of stone blocks, may yet be traced for many leagues, connecting the ruins of the once splendid cities which the modern desert contains. (See Cerville's Travels, vol. 2, p. 20, published 1825 by the Geographical Society of Paris)

In Italy, parallel stone railroads are now used, and have been used for ages in the streets of Milan; they are worthy of imitation in every town.

Mr. Wood, in his work " On Railroads," with some probability says that Mr Beaumont, of England, was the first contriver of the railroad, or at least the first who had tested its utility. Leaving this as undecided, it is certain that, in the year 1676, we find a description which cannot be misunderstood. In the life of Lord Keeper North occurs the following passage " The manner of the carriages is by laying *rails* of timber from the colliery to the river, exactly straight and parallel, and bulky carts are made, with four rollers, fitting those rails, whereby the carriage is so easy that one horse will draw down four or five chaldrons of coal, and is an immense benefit to the coal merchant."

Wooden rails have been used from time immemorial in the mines of Germany

It was not until a century ago that the rails, which had been of wood, began to be shod with iron. These iron rails were at first merely protectors of the wood but in a short time they became of greater importance, were made heavier, and now their material is steel.

AMERICAN RAILROADS.

In this country the term *railroad* is used, in England the common term is *railway*. The term *railway* applies to the superstructure, namely, the *ways made of rails*, including their supports, ties or sleepers, fish plates, bolts, etc., and their *immediate* foundation. The term *railroad* is more comprehensive, as it includes the *railway* and the *graded road bed* on which it is placed

Railroads were first introduced in Pennsylvania. In September, 1809, the first experiment track in the United States was laid out by John Thomson, Esq. (the father of John Edgar Thomson, who was afterward the President of the Pennsylvania Railroad Company), civil engineer, of Delaware County, Pennsylvania, and constructed under his direction, by Sumerville, a Scotch millwright, for Thomas Leiper, of Philadelphia. It was sixty yards (180 feet) in length, and graded an inch and a half to the yard. The gauge was four feet, and the sleepers eight feet apart.

The experiment with a loaded car was so successful that Leiper, in the same year, caused the first practical railroad in the United States to be constructed for the transportation of stone from his quarries, on Crum Creek, to his landing on Ridley Creek, in Delaware County, Pennsylvania, a distance of about a mile It continued in use for nineteen years. Some of the original foundations, consisting of rock in which holes were drilled and afterward plugged with wood to receive the spikes for holding the sleepers in place, may be seen to this day

In 1816 the first railroad on which self acting inclined planes were erected was executed by a Mr. Boggs, on the Kiskeminetas River, in Indiana County, Pennsylvania.

The Mauch Chunk railroad was the third to be finished and put in operation. It was made entirely of wood and worked by gravity. This road commenced at the coal mines which are, in fact, in the valley of the Little Schuylkill, on Panther Creek, a short distance below the summit of "Mauch Chunk," or "Mountain of Bears." It is used for the purpose of carrying the Schuylkill coal from this valley to the top of the mountain, and thence to the Lehigh River; hence, the common, but erroneous name of this coal, in the market, is Lehigh coal. The road was commenced in the winter of 1826–1827, and was finished in four months. The extent of the main line, which is single, is nine miles, and the branches and side lines extend in the aggregate three and three-quarter miles. This was the first railroad of any considerable extent made in the United States. This road was run with mules, which were walked on the outside of the track, to protect the sleepers from wearing; and, the road having considerable descent one way, the cars ran down, themselves. A low car was provided, similar to a "gondola" car, and taken with the train; and on that part of the road where the cars ran themselves by gravity, the mules were made to mount the platform of the low car, and were *carried down with the load*; and it was astonishing how soon the mules became accustomed to, and fond of this diversion.

On one occasion, the car on which the mules rode down the plane (of about seven miles in length) broke loose, and descended without its passengers (mules), and it became necessary to send for it, the mules, however, with characteristic firmness, refused to be driven down for the purpose of bringing it back. Persuasions, threats, and even the *ultima ratio* of drivers—the logic of the cowskin—could not induce these favored quadrupeds to waive their usual privileges and to submit to the degrading employment of drawing, in lieu of their pastime of riding, which they had come to look upon as a vested right. Their drivers were actually obliged to change lots with them, and harnessing themselves to the car, to drag it up to the malcontents, who triumphantly took possession of it, and resumed their wonted cheerfulness This railroad is better known to fame as the "Switchback," which has been traveled with such rare gratification by tens of thousands.

The fourth railroad was built at Quincy, Massachusetts, by Gridley Bryant, in 1827. This road, which is known as the "Granite Railroad" was designed and built by those interested in getting material for the Bunker Hill monument from the granite quarries of Quincy.

The gauge of this road was five feet, and the rails consisted of pine twelve inches deep, covered with oak plank, and protected by flat iron bars. The wooden rails were laid upon granite sleepers 7½ feet long and spaced 8 feet apart. The road had considerable incline from the quarries towards the landing place on the Neponset River, and a single horse drew immense loads over the rails. From the wharf the granite blocks were towed around the harbor of Boston by a steam towboat, and landed at Charlestown. In 1871 this railroad ceased to exist, being purchased by the Old Colony Railroad.

In the early period of railroad history in the United States, the practice was a lighter construction of the permanent way than was adopted in England. This, no doubt, has materially aided the remarkable extension of railroad lines over so great an area of country. The rails of our early railroads were composed of flat bars (strap-rail) attached to wooden stringpieces, 6x10 inches, supported on cross-ties similar to those of our present street passenger railroads. The weight of the locomotive, concentrated upon four wheels with a narrow wheel-base, was entirely too much for such a substructure. The roadway soon became uneven, and travel over it was both uncomfortable and dangerous. Very often, the end of the rail would be turned upward and forced through the bottom of the car; in railroad parlance, these were called "snake-heads," and they were often the cause of fatal accidents. On some of the early railroads, wooden piles and trestles were first introduced as a substitute both for sleepers and embankments—notably, the South Carolina Railroad and the Carbon and Honesdale (Horatio Allen, chief engineer). The superstructure was composed of flat bars attached to wooden stringpieces (6x10 inches), supported generally on piles, the latter were secured by ties The piles were driven to a great depth in some of the marshes which the road crossed, and in other parts of the work they formed a substitute for embankments.

The checks used on the Penna. Ry. are inside the boiler—so that they cannot be knocked off in case of wreck. They are very hard to keep tight, and expensive, both in original cost and maintenance.

The D. L. & W screw a plug cock onto the overflow nipple of monitor injectors and run a rod from the handle into the cab. A man can put on the heater in an instant without burning fingers, reaching outside the cab, or diverting attention from the track.

The boys on the Brooklyn, Bath & West End R. R. presented T Dickson, M M, with a gold watch for Christmas. Our subscriber, General Supt. Heindell, made the presentation speech, in which he referred to the necessity for ability in the mechanical department of a railroad.

IN THE ROUNDHOUSE AND Repair Shop.

Steam Pipe Repairs.

We present herewith 46 additional answers to our questions on steam pipe repairs These replies cover an immense territory, and show something of the interest taken by practical railroad men in subjects near their business.

We still have on hand a number of replies, which will be published next month.

PITTSBURGH, FT. WAYNE & CHICAGO.

Seldom, except when engine gets new flues—which about every thirteen months on freight. Out of 125 locomotives running into this house, we took out but five sets last year, on account of leaking. Removing, grinding and replacing, eight or nine hours, cost, $3.68. T F. BUTLER,
Fort Wayne, Ind. R. H. Foreman.

CENTRAL IOWA

When rebuilt, once in two or three years; time, one day for machinist and helper, cost, about $4.20.
J. FREW,
Keithsburgh, Ill. R H Foreman.

EAST TENNESSEE, VIRGINIA & GEORGIA

If cylinders are not loose on arch, from 12 to 18 months, extension fronts five or six months sooner. Time, from three to four hours cost, $1.54. I have done away with the copper gasket under exhaust stand, and made a ground joint, it does much better W L TRACY,
Atlanta, Ga. R. H Foreman.

DELAWARE & HUDSON CANAL CO.

Average eight hours on the work, cost, $3, more if joints are very bad.
C. O. VEDDER,
Binghamton, N. Y. R. H. Foreman.

Only when in for general repairs; time, eight to ten hours; cost, about $8.35.
JACOB EITEL,
Carbondale, Pa. R. H. Foreman.

Grind pipes every six to eight months, time, about eight hours, cost $3.
THOS. HOWARD,
Oneonta, N. Y. M. M.

Have engines here out of shop 20 months, and steam pipes good yet, machinist and helper have taken down, ground and replaced a set in six hours.
J. HINTON,
Quaker St., N. Y. R. H. Foreman.

About once in twelve months, time two hours per joint, cost $1.10.
SAM'L BOOTH,
Schenectady, N. Y. R. H. Foreman.

About once in two years; true rings up in lathe, and steam pipes off with reamer; saves grinding; have ground a set and sent engine out in five hours, cost, about $4.50 to $5.
J. A. WISHART,
Plattsburgh, N. Y. R. H. Foreman.

DENVER & RIO GRANDE.

When they leak; takes machinist and helper eight hours, cost, about $3.75 to $4.
C. H. S.,
Denver, Col. R. H. Foreman.

ON THE WEST SHORE.

It takes us from five to eight hours, depending on the condition of joints, costs 60 cents per joint.
JOHN HOWARD,
Frankfort, N. Y. R. H. Foreman.

LOUISVILLE & NASHVILLE.

Time run, from nine months to three years, according to engine. The whole job takes ten hours for two men, cost, $5.
P. RYAN,
Russellville, Ky. R. H. Foreman.

Not done very often, takes 10 to 24 hours, costs from $4 to $10, according to condition. We have had more trouble with leaky pipes on account of the saddle being badly fitted to the smoke arch, than from any other cause.
CHAS. BEAN,
Pensacola, Fla. R. H. Foreman.

HOUSTON & TEXAS CENTRAL.

Only when putting in new flues; time, about ten hours; cost, about $4.50.
J. H. DEHN,
Walnut Springs, Tex. R. H. Foreman.

ATCHISON, TOPEKA & SANTA FE.

Depends on kind of water used; here we have good water, and joints seldom leak, but on some of our southern or desert divisions, where the water contains alkali, soda or salt, it is very hard on all steam joints, there they do not last over eight months on an average. It generally takes ten hours to do the work. Cost, about $4.05 for four joints.
W. H. TRAVER,
Denver, Col. R. H. Foreman.

When I find joints leak, we take the bolts out, oil and tighten up, thus often saving the expense of grinding. If they have to be ground, it takes a machinist and helper from 10 to 20 hours.
WM. LAWRENSON,
East Las Vegas, N. M. R. H. Foreman.

On this division (So. Kansas), we use Blood engines, and have no trouble whatever with steam pipes. Do not remember of ever having ground in a whole set at once.
J. BUSWELL,
Ex. R. H. Foreman.
Cherryvale and Wellington, Kan.

Average once in 12 months, life of a joint very uncertain in extension front. If front is air-tight they last very well, but if the accumulation of cinders ignite, it injures joints. I have taken out pipes from short fronts that no one knew how long they had run. Time, about eight hours; cost, about $4.
JOHN M. WEIGLE,
Nickerson, Kan. R. H. Foreman.

Takes us about seven hours, and costs about $1.60 to grind only.
JOHN KIRK,
Emporia, Kan. R. H. Foreman.

SOUTHERN PACIFIC.

Steam pipe repairs are governed by so many circumstances that affect the time and cost, that I doubt if there are many cases alike. Our engines run without this work about three years, time, five hours for handy man and helper, cost, about $2.75. Wages are a little higher here than in the East, but we work our men a little harder.
R. E. FRENCH,
West Oakland, Cal. R. H. Foreman.

Pipes generally last as long as the flues, unless bolts break. Time, ten hours, cost, $6.25.
C. F. HALL,
Tulare, Cal. R. H. Foreman.

TEXAS & PACIFIC.

Takes two men two days, and costs about $9.
G. F. MILLER,
Toyah, Tex. R. H. Foreman.

Diamond stacks and short fronts, 12 months, extensions, six months. Time, about 20 hours; cost, $6.
G. W. DEATS,
Ft. Worth, Tex. R. H. Foreman.

CHICAGO, MILWAUKEE & ST. PAUL.

Not often done; if not cut too badly, eight to twelve hours will do the work, cost, from $2.50 to $3.
EDWARD WILLIAMSON,
Oxford June., Iowa. R. H. Foreman.

As often as we renew flues, say from one year to 18 months; time, average, ten hours. We use a ball reamer. If the lower joints came up higher, free from accumulation of dirt and water, they would last longer. We have recently renewed six sets of pipes that were cut out by cinders.
A. J. EDMONDS,
Mason City, Ia. R. H. Foreman.

OHIO & MISSISSIPPI.

Takes from 12 to 15 hours, costs about $3.
L. DE LONG,
Louisville, Ky. R. H. Foreman.

DELAWARE, LACKAWANNA & WESTERN.

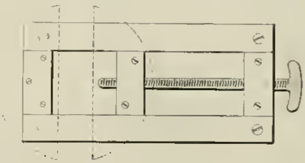
When needed; use a ball reamer. Time depends on conditions; from two hours to all day; cost, $2 to $6.
JOHN MUIR,
Kingsland, N. Y. Foreman Machine Shop.

CHICAGO & ALTON.

We find that by using a wooden plug to hold ring, and using a brace, we can do double the work we did by holding ring in the band. Have ground in pipes in eight or nine hours, but some cases are so bad it takes two days. Cost, for removing, grinding and replacing, from $4 to $5.
W. P. STRUNK,
Roodhouse, Ill. R. H. Foreman.

CHICAGO, ROCK ISLAND & PACIFIC.

Only when pipes are in the way replacing flues, a machinist and two helpers complete the job in a day; cost, about $6.
JAMES MIRFIELD,
Rock Island, Ill. R. H. Foreman.



CANADIAN PACIFIC.

Practice on this road differs very much, here we use water rank with alkali and a native coal, but do not grind pipes very often. Usually put a helper on the job if we have time; usually six to eight hours; average cost, $2.50. Herewith find sketch of a very handy ring holder, it is made of wood, except the screw; the half-rounded pieces of wood shown in dotted lines are screwed to the blocks, one of which travels on the screw. They are cheaply renewed, and do not spring the rings.
H. G. GORHAM,
Locomotive Foreman.
Swift Current, N. W. T., Canada.

Only when they give out, which is only about 1 per cent. per annum on this road. One man can do them thoroughly in ten hours. Cost, including removing and replacing, $5.
C. R. ORD,
Hochelaga, N. T., Canada. R. H. Foreman.

GRAND TRUNK.

Seldom done except engine has general repairs. It is one day's work for one man, for the style joint we are using. Labor, about $2.50.
J. N. MARTIN,
Portland, Me. M. M.

Seldom required, unless putting in tubes or other work. Take down, grind and replace in eight hours, costing $3. This is on the assumption that faces have not been cut to any great extent, and that no bolts break and have to be drilled out; in such cases, the cost runs up.
W. F. BROUGHTON,
R. H. Foreman.
Niagara Falls, Ontario, Canada.

Done very seldom; on brass ball joints, about ¼ day for a mechanic and helper.
WILLIAM BALL,
Richmond, P. Q., Canada. R. H. Foreman.

As a rule they run from one general repair to another. We can grind the joints in two hours, but to take down, grind and replace, it will take a day, cost, two men at 20 cents per hour.
S. C. MCNEILL,
R. H. Foreman.
Pt. St. Charles, Montreal, P. Q., Canada.

N. Y., NEW HAVEN & HARTFORD.

If cylinders are not loose, not over once a year, time, about ten hours, cost depends on price of labor employed, usually from $4 to $6.
EDWIN CHATTERTON,
New Haven, Conn. R. H. Foreman.

Boiler maker and helper do all this kind of work, and it generally takes two days, as all our engines have extension fronts, costs, to grind the joints, $2.25; to do the whole job, $5.
DAVID GIBSON,
Bridgeport, Conn. R. H. Foreman.

A machinist and helper generally do this work, think joints last longest in extension fronts, takes about two days for the job.
C. C. LACKY,
Hartford, Conn. R. H. Foreman.

Our engines are overhauled in from 20 to 36 months, and we do little flue work outside of what they get there; have not ground a set in three years. Time, from 8 to 15 hours, cost, from $5 to $15.
GEO. H. PLATT,
R. H. Foreman.
Harlem River, North N. Y. City.

SOUTHERN KANSAS.

No trouble with joints, can grind in all joints in five hours, cost, $1.37½.
S. ECKNAYR,
Ottawa, Kan. R. H. Foreman.

INTERCOLONIAL.

From 18 months to two years, takes two laboring men one day; cost, $2.20. We use the loose ball joint, and have no trouble with it.
N. L. RAND,
Moncton, N. B., Canada. R. H. Foreman.

CHICAGO & NORTHWESTERN.

Seldom leak, time, from one to four hours. Price depends on condition of joint and price of man on work.
WM. HUTCHINSON,
Council Bluffs, Ia. R. H. Foreman.

FLORIDA SOUTHERN.

Once in two years, have no trouble.
W. H. YOUNG,
Palatka, Fla. R. H. Foreman.

KANSAS CITY, FORT SCOTT & MEMPHIS.

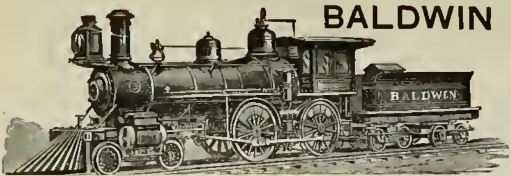
Have never ground in a joint, except when engine goes in for repairs, but most of our machinery is new.
P. T. BUTTERLY,
Springfield, Mo. R. H. Foreman.

PHILADELPHIA, WASHINGTON & BALTIMORE.

The average not one per month out of 65 engines. Use a handy man, time, about two days, cost, $6.
JOHN BREAR,
Wilmington, Del. R. H. Foreman.

LOUISVILLE & NASHVILLE.

If joints are well made when new will last till engine is shopped for flues; time, about one day. I would state that, when we have a joint leak, we invariably find a cylinder working loose. Our cylinders are double-bolted to a ring 1¼ by 6 inches wide, and joints are very low in the arch. They are all cast-iron, we use no brass or composition joints, we protect the inside of exhaust pipe joint with a small apron.
EDWARD MARRIOTT,
Louisville, Ky. R. H. Foreman.



BALDWIN LOCOMOTIVE WORKS.

ESTABLISHED 1831.

ANNUAL CAPACITY 650

LOCOMOTIVE ENGINES,

Adapted to every variety of service, and built accurately to standard gauges and templets. Like parts of different engines of same class perfectly interchangeable.

Broad and Narrow-Gauge Locomotives; Mine Locomotives by Steam or Compressed Air; Plantation Locomotives; Noiseless Motors for Street Railways, Etc.

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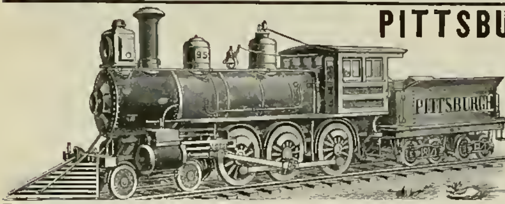

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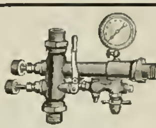

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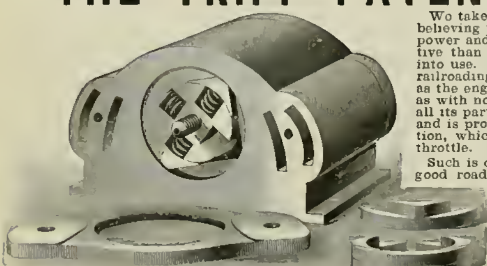

We take pleasure in presenting this Valve to Railroad men and others, believing that its use on a Locomotive Engine will effect a greater saving of power and expense in the maintenance of the working parts of the Locomotive than has been accomplished since the Locomotive was first brought into use. We also believe that its use will add largely to the safety of railroading, and prevent the destruction of many lives and much property, as the engine can be reversed as easily with 160 lbs pressure on the Valve as with no pressure, it being a **Perfect Balance Valve.** The Valve in all its parts is as durable as any of the working parts of the Locomotive, and is provided with a relief device, simple in its construction and operation, which relieves back pressure instantly when running with closed throttle.

Such is our confidence in this Valve that we will furnish a pair to any good road for trial, on their furnishing following dimensions: 1st Diagram of cylinder face showing ports. 2d. Travel, inside and outside lap of valve. 3d. Distance from cylinder face to center of valve stem. 4th. Size of valve stem. 5th. Length, width and height of steam chest from cylinder face. Internal measurements.

Said Valves not to be paid for until they have demonstrated their value to the satisfaction of the road.

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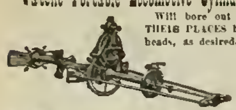
Patent Portable Locomotive Cylinder Boring Machine.



Will bore out Locomotive Cylinders IN THEIR PLACES by removing one or both heads, as desired, and piston. THE END THRUST IS ALWAYS IN EXACT LINE WITH BAR. It is fed with constant feed of cut gears.

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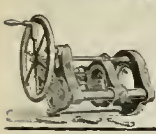

For turning off Crank-Pins IN POSITION and while wheels are under the Engine, keeping the original centres of the Pin.

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Manufacturers of
Special Tools for Railway Repair Shops.
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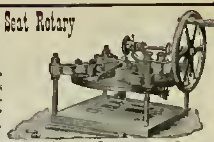

Will face off the Valve Seats of Locomotives and other Engines perfectly true, without the use of files or scrapers.

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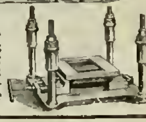

Used in combination with Valve Seat Rotary Planing Machine; quickest and easiest way of facing a valve; obviates use of planer; adapted to round-house and repair-shop work; adjusted by the four graduated columns.

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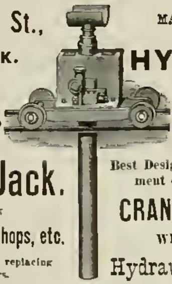

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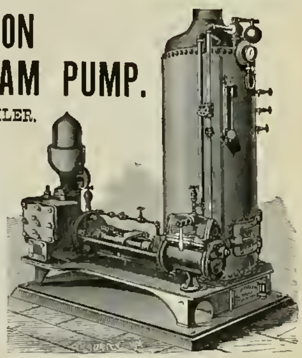

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Foot of East 23d Street,
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One important defect in the imitations referred to is *insufficient opening* for inlet *of steam or* Fluid, *thereby checking the flow*. Purchasers of Valves should be careful to know that they are of capacity suited to size of pipe to which the Valves are to be attached. All Valves manufactured by

Jenkins Bros. are Warranted Full Opening.

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SIBLEY'S PERFECTION VALVE OIL,
The only perfect Locomotive Valve Lubricant.
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Stronger and more durable than iron forgings in any position or for any service whatever.
40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.
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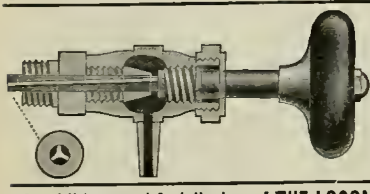

Every movement of the handle cleans out the tube. A bronze valve on a brass seat. Will not leak. Valve seat readily taken out for examination or repairs. Heavy, well made and adapted for the severest locomotive service.

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The Cut shows our
PATENT PLATE BENDING ROLLS,
Specially adapted to this work.
HILLES & JONES, M'frs.,
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Represents all sizes that are driven by belts.

It is but the work of a moment to balance the top roll and lower the hinge housing to take out the plate when a full circle is bent. The rolls are all made of solid wrought iron, the balance bar being a part or extension of the top roll. There is a cast-iron bedplate under the entire machine. To save any shifting of belts we put in Friction Pulleys which enable the rolls to be started, stopped or reversed instantly.

THE GLACE LOCOMOTIVE CHECK VALVE.

Three Separate, Distinct and Independent Valves in One Case, insuring Freedom from Sticking, and obviating difficulties experienced with old-style single valve.

POPULAR WITH ENGINEERS
Wherever Tried.

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Locomotive Pop Safety Valves, Guide and Rod Oil Cups, Railway Brass Goods, etc.
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THE LOCOMOTIVE ENGINEER.

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THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. II. | NEW YORK, FEBRUARY, 1889. | 1.00 per Year. or 10c. a copy.

Danger of Recalling Flagmen by Whistle.

Another awful wreck has happened, this time at Tallmadge, O. It was a bad night, and a train broke in two, getting on to a siding. The engineer sent out his fireman to stop a passenger train, and then went back to get the rest of his own train. He blew a signal to call in the rear flagman; the fireman mistook the signal for him, and came in, letting the express crash into the freight, causing several deaths, the train taking fire from the stoves and roasting those imprisoned in the wreck.

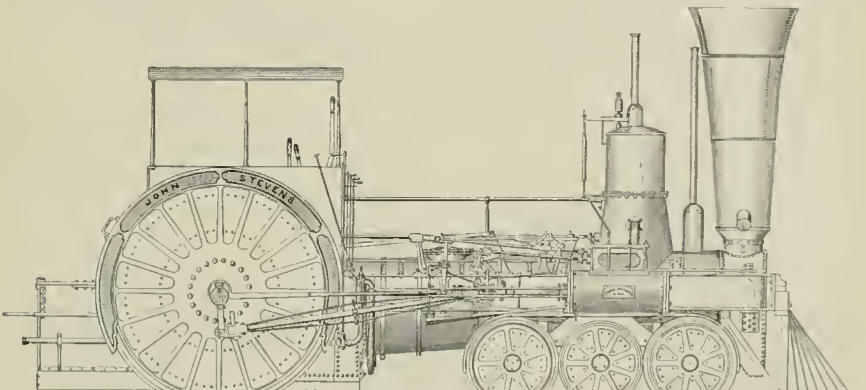
The rule that five whistles call in one flag and four another is always open to mistakes of this kind.

We believe that a whistle signal to call in a flag should not be allowed, except for the head end. If, in all cases where a flag has been out, a torpedo is placed, it would be a warning to approaching trains to run slow; but the recalling of all protection on a man's ability to detect the number of blasts of a whistle is dangerous—especially so where another line runs very close.

The recalling of one flag and not the other is sure to leave a loop-hole for wrecks.

There is not half enough flagging done in this country, and what is done is not done half well enough.

Division 400, B. of L. E., has been organized at Mount Carmel, Ill. Four hundred active lodges don't look much like "a disbanded organization," that some people expected if the "Q." strike failed.



Historical Locomotives

FIFTH SKETCH.

On our first, second and third pages will be found engravings of the "John Stevens," the first of the series of 8-foot wheeled passenger engines once famous for fast time on the old Camden & Amboy road. These engines—seven in number—were built at the Norris Locomotive Works, Philadelphia, Pa., to the order of that eminent engineer, Edwin A. Stevens, afterward well known as the founder of the Stevens Institute of Technology, Hoboken, N. J.

The picture on the first page represents the engine as she was originally built, and is taken directly from the original drawings—kindly placed at our disposal by Henry L. Norris, Jr., of Philadelphia, grandson of Richard Norris, founder of the once famous works that bore his name, and a son of Mr. H. L. Norris, then associated with his father and uncle, and who made these drawings at that time. The original order entered upon the order book of the works reads as follows

"One passenger Loco. for Camden & Amboy Ry. Gauge 4 9½'

Boiler. 38 inches diam , made with spiral seams to burn anthracite coal, the steam dome to be put on cyl. part of boiler, with steam pipes leading to steam chests.

Cylinders. 13x34 inches Horizontal.

Cut Off Worked from an eccentric on outside of shackle pin.

Guides. Of steel, with block and heads

Crossheads. Of wrought-iron, with cylindrical journals.

Wheels. 2 driving wheels, 8 feet dia.

Axles. Axle 6¾, truck wheels with tires 36 dia. Axles 4 dia.

Tubes. 98 of iron, 2 dia , 12 long.

Name, John Stevens, No. 28, tried April 17, 1849."

These engines were not to exceed 50,000 pounds, and the road furnished their own tanks. No weight is given of these 8-footers, but one, the same in every way, except that it had a 7-foot wheel, is recorded as weighing 49,253 pounds, so the 8-footer must have come very near the mark.

Both the driving and truck wheels were made of wrought-iron, and the spaces between the spokes filled with wood.

The boiler is very small—38 in. diameter—with but 98 flues. In the longitudinal section on page 3 can be seen the plan of staying, the long rods among the flues being then deemed a necessity. The fire-box was 5 feet long, no width given, but it could not have been over 48 inches; the crown bars running lengthwise were stayed to outer sheet by bolts, spaced 10 inches apart. The dome was very large, and had a flanged joint near the center of its height, the throttle was of the old slide pattern, encased in a box that was located on top of an arch pipe that went out each side of dome to the chests; there was a dry pipe above the throttle.

The fire-door was below and behind the axle, and the fireman stood in a pit, the bottom of which was on a level with bottom of ash-pan, the tank deck being about breast-high.

On top of the dome was a safety valve whose lever extended to a spring scale, shown just back of dome, this was the only means of knowing the pressure carried—as steam gauges were not then in use.

Near the stack is shown a safety-valve that was encased, to prevent the men from meddling with it.

J. W. Sanford, M. M. of the Penna. shops at the Meadows, Jersey City, fired and ran this engine and others of its class. He says they used to pull six of the old, light cars, but even this train was more than they could handle well. They were not provided with sand boxes, and were slippery and very slow to get a train under way, but, once in motion, with a light train, they would run as fast as men cared to ride. Mr. Sanford recalls the experiments made with different kinds of smoke stacks, one of which terminated in an elbow at the top, with a loose joint, and provided with handles, with which to turn it out of the wind.

The one shown had a place to clean it out, and the lower extension of smoke-box also had a cinder slide.

The exhaust pipes were carried from the chests along each side of the boiler between the frames, and entered the side of smoke-box about half-way up. This engine and its mate had a stroke of 34", but the rest of the series had 38" stroke.

The steam ports were only 8" long by 1 1/8" wide, the exhaust ports 8" by 2".

The cylinder cocks were of the old, independent kind—fireman had to run around the engine and close them up after the engine was in motion.

The pump was provided with ball valves, and the plunger received its motion from a lug, keyed to the piston rod. The feed was delivered in the front of the water leg, just above the mud ring—about the worst place it could be got. The 6-wheeled truck was pivoted to the boiler so far back that it carried most of the weight, making the engine very deficient in adhesion and prone to get off the track. The center pair of wheels were without flanges. The peculiar plan of arranging the truck springs is shown on this page, and seems to have some advantages over modern devices.

There were no seats, the men standing up to their work all the time; the gauge cocks were outside of the cab, and reached by rods, and, in order to be seen and heard, they were large—and often froze up in cold weather.

To the younger generation, the valve motion will seem complicated; the two main eccentrics were located inside the wheel and operated the large hooks, shown with the curved lifting rod, these worked the main rocker arm and the main valve, and the reversing was done by changing from one hook to the other by handling one of the levers in the cab. The independent cut-off was a small valve, riding on top of the main valve, and operated by the return crank eccentric on the main pin; this motion was transmitted to the valve through the back rocker.

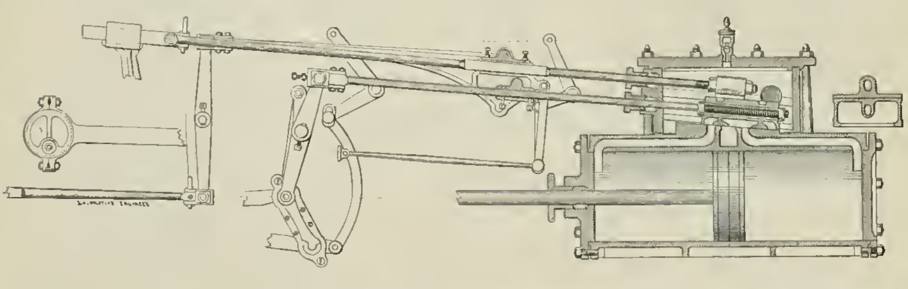
It will be seen that the back end of the upper valve stem was supported in a guide, and at the end of this square part of rod there is a joint, to which is pivoted the rod whose other end terminates in the double **V** hooks. This loose end is supported and held by the bell crank, shown just back of the cylinder. On the upper valve stem there is a loose block, running as a crosshead on a square section of the rod; this is driven by the cut-off eccentric; just below it, on the main valve stem, is another block, held rigid by set screws; this block also carries a pin that can be engaged by the lower **V** of the double hook.

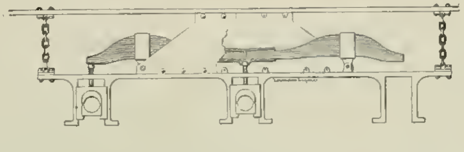
Now, in starting, the cut-off lever was moved so as to engage the lower hook. This made the cut-off valve come to the center of the main valve, and, as that always ran full stroke, it would cut its own steam off, the cut-off motion merely sliding the block on the upper rod back and forth, and doing no work. As soon as the engine was under way the engineer "threw on the cut-off," which disengaged the lower hook from the main valve stem, and engaged the upper one with the cut-off valve, which traveled on top of the main valve, cutting the steam off short, much as a link does when hooked up, except that, as the main valve controlled the exhaust, it was carried well to the end of the stroke.

The throttle lever is shown as the back lever in the cab, with rod running over top of boiler to dome. There was a handrail over top of boiler, no running boards being used.

These engines ran from 1849-50 to 1861-2, and one as late as 1865, two of them were cut up and the others were also cut up, with the exception of the cylinders and guides, these being used on some 8-wheeled engines with 6-foot wheels, that were built at that time.

Engineer Timothy Hennessey, of Moberly, Mo., has been elected Railroad Commissioner of his State, for a term of six years.





Getting an Injector Down Fine.

Engineer John McIvor, of the Rio Grande road, is an expert manipulator of the throttle and brake valve on mountain engines, and, when he figures on a thing, is nothing if not correct.

Some years since a new class of engines came onto the road, that were supplied with a different make of injectors than they had been using, and John got one of them. One of the officials, anxious to know how the new instruments were going to do, asked John about them. "Well, sah," said John, "I can put this engine on a side track, slow the air pump down to three strokes per minute and set that squirt to just supply her—if the throttle gland leaks she'll loose water! Fine, why, it works finer 'n silk."

During the year just passed, the Rhode Island Locomotive Works built 229 locomotives, divided as follows: 56 10-wheelers, 52 moguls, 44 Forneys, 40 8-wheelers, 21 6-wheeled switchers, 12 consolidation and 4 4-wheeled switchers.

The *Northwestern Mechanic*, Vol. 1, No. 1, has made its appearance at Minneapolis, Minn., in place of *Wood and Iron*, deceased. It is in much better shape than the old paper, contains more matter, and has no "overcoat."

Air Brake Practice.

NINTH PAPER.

By J. E. PHELAN.

In eighth paper on Air Brake Practice, January issue, regarding excessive pressure of air, and air cylinders of air pumps heating, the following occurs: "Often air pumps are not properly cared for, and all kinds of dirty oil being used, and allowed to be sucked in through air valves, dust accumulates and gum forms, until air passages become contracted, and adding to and increasing compression and friction in consequence." In the eighth paper we did not go into the why and wherefore, or the philosophy of increased air compression and friction in air pumps, but we are now prompted to it by a letter received from an intelligent engineer employed on the Canadian Pacific Railway, at Winnipeg, Manitoba. This letter from Chas. Pope is far too valuable to go uncared for and unseen, for it contains elements that show up to the enginemen's credit in having progressive thought and thinkers in the ranks, men who seek the why and wherefore in a philosophical and manly way. Hear an extract: "In reading the eighth paper, it has occurred to me that there may be another cause for air cylinders becoming hot when air is compressed at a rapid rate to a high pressure, say to five or six atmospheres. I refer to a natural law, viz., the friction of the air upon itself. According to some of our best American authorities, the greatest obstacle to economy and the practical working of thermodynamic engines arises from this natural law of heat generated during compression, and the low temperature caused by the release of compressed air.

"Although this law of the low temperature caused by the release of air does not, at this time, affect the friction, I have often verified it by the comparatively cold temperature of the air which escapes from the drip-cock in reservoir of engines.

"A lack of facilities has prevented me from testing the increase of temperature, which, under this law, takes place in the air cylinder during compression, and, as the friction of the air ceases as soon as it *becomes at rest*, and the heat which is generated by compression is soon lost, or absorbed by the cylinder itself and other parts, it hardly makes any perceptible difference in the outside temperature of main reservoir.

"Now, as I don't go much on theory unless it is verified in practice, I would like to ask if you do not consider that this law of heat during rapid compression is another important factor in causing the troubles referred to in your paper. If so, it is another very powerful argument in favor of running the air pump at as moderate a rate of speed as is consistent with the requirements of the service."

In this you find clear-headed reasoning that conforms with good practice, and likewise bears out natural law. Hence our assertion: "Air passages become contracted, and, adding to and increasing compression and friction in consequence," will bear further expansion and explanation.

We have often thought air pumps would be better for general and heavy work if made larger.

While air brake trains have lengthened, and air brake cars increased to an indefinite number, air pumps have increased in diameter two inches, with shorter, and consequently quicker stroke. Our reason prompts us in a desire to see an air pump that will increase largely the volume of air to be gained at each stroke, and, in consequence, make the strokes fewer in number and more moderate in speed, and better generally for maintaining an adequate air supply with slight exertion.

But our mission is not to suggest improvements in present appliances, so much as to make the best possible and most skillful use of appliances now existing.

But this principle of air heating by friction will prove interesting to many thoughtful and reasoning enginemen. We may call it the friction of air upon itself, increased compression causing increased friction, or the simple entrance of heat into the air in air chamber of the air pump, when at work.

It remains our privilege to trace the cause. We used to read Prof. Balfour Stewart on Physics, and therein learned that entrance of heat means the entrance of some kind of vibratory, or backward and forward, motion. Heat in itself is vibratory motion. A heated body has its particles in rapid motion, so that, when a body is heated, each extremely small particle of it is moving about, either forward or backward, or round and round.

Mr. Pope remarked the friction of the air ceasing as soon as at rest. Herein he found the principle. Heat enters by friction, or rapid motion, or intense compression, all centered in rapid motion of air particles. As soon as this motion modifies or becomes at rest, heat departs, unless it has in meantime become, as we may term it, stored in metallic substances surrounding air chamber.

Now, if we start an air pump, and run it rapidly until it pumps a pressure into main reservoir of 100 lbs., or to seven times atmospheric pressure, and continue running the air pump at as rapid a rate as 140 lbs. steam may drive it against such pressure, imagine what kind of a devil's dance there must be among the particles of air compressed in the air cylinder; especially if air passages are gummed up and contracted to less than usual size or required opening.

Even at 80 lbs. pressure it is contracting considerable force and energy into a small space. It is a matter of energy producing heat, and the less energy you place there the less heat you will have.

Think of the compression in this air cylinder, or the simple matter of force against some obstacle or opposing force. Or, in plain Anglo-Saxon, your pump, drawing an amount of air from the atmosphere very easily, but meeting with stout resistance when it attempts to force it against the opposing pressure, or through a too narrowly contracted passage.

You cannot help readily seeing the friction that must come from the air particles pressing hard in this limited space. It is simply a matter of friction producing heat. Rub two sticks together rapidly enough and long enough, and heat will be produced. The same principle applies to air or any other substance. Hard hammering or successive blows will produce heat, clapping your hands together, for instance. Think of the pounding an air piston must do on this compressed air, when seeking to put it somewhere, faster than it can be really accommodated.

Heated bodies also expand, and once the heat enters, and your pump keeps bringing in and adding cool air, and, in addition to its being compressed, and having to oppose this obstacle of high pressure, and contracted passage, being expanded by heat, and filling out so much more in consequence—is it to be wondered at if air cylinders get hot?

It is simply the matter of the engineer creating a little hell for himself, within the bounds of the air cylinder.

Heated bodies expand—get larger in all directions, and this heat from the air communicates to the brass air valves, and, if they are a snug fit, they expand in greater proportion than iron bushing or casing holding them, and trouble increases and pounding begins. But the remedy comes in piston rod getting hot and burning out the packing, and brings the engineer to realize the situation. Then the pump is allowed to run slower, and, while it runs at slower speed, half the air it absorbs from atmosphere is wasted through stuffing-box, and still the brakes are kept at work in a way.

When once the principles are understood, thinking enginemen will have little trouble running air pumps at proper speed, and handling engineers' brake valves and train brakes in a skillful manner.

Let us get January issue of THE LOCOMOTIVE ENGINEER, and read the eighth paper again.

Rate Cutting Remedy.

A bill has been introduced onto the Wisconsin legislature, that is intended to prevent rate cutting. It provides that rates shall never be raised, that the lowest rate reached during a cut shall become the fixed rate for that service until another cut shall be made. At first thought this looks as if it might prevent some of the ruinous cuts that do so much harm to the roads, preventing them from paying dividends, crowding the lines with traffic one month, and causing a cut in wages and a reduction of the number of men employed the next. Rate cutting is a menace to the safety of every employe on the road; cuts his pay, hurts the company, and stagnates the business of the country. If the Wisconsin legislators can scheme up any way to prevent it they will do the country a service.

A Southern Railway Shop.

For some time the tramp philosopher of this publication has contemplated a winter campaign against Richmond, and, inscribing on his mental banner the war-time motto—"On to Richmond," he struck out. Having first arranged for transportation for his baggage, and with three days' rations in his grip, he advanced, by forced marches, and reached the walls of the historic city, only encountering one charge—the Pullman porter's—this he easily repulsed, although the colored troops fought nobly to make the charge a success.

A RAILROAD CENTER.

Richmond has many railroads, some of them among the earliest in America—the Petersburg R. R. having been chartered in 1830 and opened in 1833. There is here also an extensive locomotive works, and at Manchester, just across the James river, one of the largest and best equipped railroad shops in the South—those of the Richmond & Danville Railroad.

THE MANCHESTER SHOPS.

These shops were originally built for a road 140 miles in length, but this road has absorbed many other smaller roads, until now it has 2,383 miles of track, 275 locomotives, and nearly 6,000 cars, yet these shops, with nothing like a proportionate increase in size, do the principal work of the entire system.

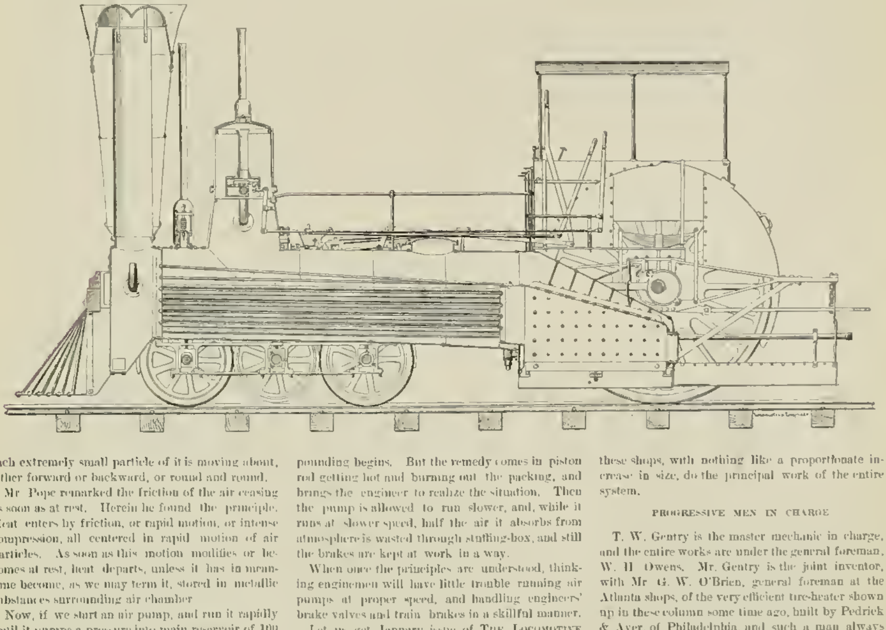
PROGRESSIVE MEN IN CHARGE.

T. W. Gentry is the master mechanic in charge, and the entire works are under the general foreman, W. H. Owens. Mr. Gentry is the joint inventor, with Mr. G. W. O'Brien, general foreman at the Atlanta shops, of the very efficient tire-heater shown up in these column some time ago, built by Pedrick & Ayer, of Philadelphia, and such a man always has a shop a little out of the general run.

The shops lay along the James river bank, and are of brick. The main shop, wood shop, and roundhouse were built before the war, and were used by the Confederate army as a hospital, one side of the roundhouse was used as a dead-house for the hospital, and it retains its ghastly name to this day.

There are extensive car shops and paint shops for passenger equipment, with all the usual attachments of upholstering, lacquering and drying departments. The passenger cars have the new, quick-acting, automatic brake, the whistle signal apparatus, are heated by the Martin system of steam heaters, and provided with Janney couplers—about as modern as any. All the new freight cars have automatic brakes and Janney couplers.

A very neat arrangement for raising water from tanks under the floor is used in some of the special cars built at these shops. Air is taken from the auxiliary drum for this purpose, but the car is sup-



plied with a hand pump, to use when there is no pressure under the car.

THE FOUNDRY.

The foundry is large, neat and light, and has the reputation of turning out some of the best and cheapest work in the country; cylinder castings are very smooth and clean, and are turned out at a very low cost, as they are finished complete for $132 per pair. This foundry does all the work for the entire system, and as all the little roads, that form the gigantic whole, had all kinds of power, the pattern storehouse is full of odd sizes of all manner of things that are gradually fading away as the old mills are scrapped.

USE OF COMPRESSED AIR.

These shops use compressed air for many purposes, one of which, the moving of oil, we illustrated some months ago. This air is found about the place everywhere, to test brakes, etc. In the roundhouse they are putting in a new drop-table, of Mr. Owens' design, that will be operated by air pressure; they also have in the shops lines of steam pipes, with which they run a small engine for cylinder boring, and have attachments in the machine shop to test valves of all kinds, and also to fill up boilers of locomotives being rebuilt, to test joints and connections, and to finally run them out of shop. In the roundhouse there are connections at every stall, to attach a hose to blower pipe, to blow engines that are being fired up, with cold water in them.

A MODERN IDEA.

In the boiler shop they are building a heavy, standard, locomotive boiler, to take the place of the one that now supplies power for the shop, instead of painting up and using a condemned one off some old locomotive.

THE ROUNDHOUSE.

The roundhouse is a complete circle, and was, when built, amply large for any engine in the country; now they have been obliged to chip out the brick each side of the doorways, to let the cabs of their new consolidation engines in, and then, as the engines were considerably longer than the pits, they took off all the doors, and headed the engines in, and the big leviathans look like the picture of the fabled camel, who asked the privilege of putting his head into some fellow's tent and then took his hump in, their tanks stick out of the house so far that they cannot use sweeps on the turntable, and are so close to the doors that a No. 10 man cannot get by them.

MAIN SHOP.

The machine shops are fairly well equipped with tools, and there are many kinks used about them that show the natural genius and ability of Mr. Owens; some of these devices we hope to be able to illustrate at no distant day; the machine shops are run by a sleepy old full-stroke engine, making about twenty-five revolutions a minute, that positively makes a fellow feel tired and lazy to look at it.

There are six pits, and they are always loaded; some of the old engines—marked, M. W. Baldwin & Co.—look real modern with new boilers, injectors, etc.; many of these old engines were overcylindered, and Mr. Gentry has been giving them a little medicine in the shape of larger boilers of heavier metal, and six-inch iron decks.

It is surprising how quickly and cheaply tires are removed and replaced here, where the men have the Gentry-O'Brien device down fine. The storehouse is very extensive, and carries a very large stock of everything in the railroad line, from a union depot to a match.

THE BONE YARD.

Out in the cemetery track—without which no railroad shop can count itself well managed—we noticed three old wood burners, ready to be cut up; they were small engines, and old style, but have done a world of work in their day, it is hard to tell just what make they are; they were, no doubt, thirty or thirty-five years ago, Norris engines, but during and since the war they have been grafted with sprouts off Mason's and Rodgers', and Baldwin's, till their own mothers would not know them.

In the shops there was one wood burner getting slight repairs, the only wood burner the corporation has left.

LOCOMOTIVES, GREAT AND SMALL.

The new engines of the company are large and modern engines, and predominate in numbers, still they own an awful lot of old engines of all classes, that seem too good to throw away, and yet there is little doubt it would pay to do so. This road, in common with all others, do not find the big engines of to-day as good, in proportion to their size, as the little engines of the '60s and '70s. The little 16-inch engines, now being crowded to the wall, were wonderful pieces of machinery for their weight—there is no rubbing that out.

THE ENGINEMEN.

The engineers on this road run by the mile, freight men getting 4 cents per mile, the firemen get $1.60 per day, 30 days every month, whether they work or not, do not have to clean the engines at all, and seem contented with their remuneration. Extra firemen are allowed to help on running repairs in the roundhouse, and the management of this department find that it pays to let them pick up all the pointers they can in this way, old firemen are thus taught to care for packing, face valves, set up wedges, grind in cocks, and do similar work, besides being where they see and understand what must be done to get an engine in when broken down, as they see all the break-downs here, instead of only those on their own engines on the road.

Opportunities of this kind develop men, and in the end it pays the company in gaining efficient, capable and *thinking* engineers. Roads that want men to throw six tons of coal over a division twice a day, and then clean $2 worth for their ride, can't expect to post their firemen, or make engineers of them—they don't give them time to think.

We must say that the enginemen of the R & D are as intelligent and gentlemanly a set of men as ever looked at the philosopher on his rounds, and wondered whether he was a life insurance agent or a brigadier-general in the Salvation Army

Richmond Locomotive and Machine Works.

On a recent visit to the South we had the pleasure of inspecting the Richmond Locomotive and Machine Works. These works occupy the shops formerly used by, and are successors to the business of, the Tanner & Delaney Engine Co., and do a large business in stationary engines, boilers, farm engines, logging locomotives, street cars, etc.

They have for years built small locomotives for many purposes, and have commenced the manufacture of standard gauge locomotives only in the last year or two.

The shops are large and roomy, well equipped with machinery and appliances; they are now building an addition to their machine shop, that will just double the floor space, and have invested $60,000 in new machinery for it.

They had in the shop three locomotives—one, a ten-wheeler for the Georgia Pacific, that was as well designed and as modern a looking piece of machinery as one would see in any place. A street car motor for the Richmond & Seven Pines road was complete, and a very handy little engine it was. They also have a gas-burning motor in course of construction, as well as several pole road locomotives.

These works built the handsome motor cars for the electric road in Richmond, better designed and better finished street cars than usually seen.

Mr W Simpkin is the superintendent in charge, and he is paying particular attention to the locomotive department of the business, it being the intention of the company to fully develop locomotive building in the South. And there is no good reason why they should not.

The new dress and size of the *Fireman's Magazine* puts it far ahead of all other labor organs. Editor Debs has a way of showing up wrong and abuse that is at once conclusive and manly. The firemen are justly indignant, that, after all they have suffered and lost in the "Q." strike, the engineers should proceed to call off that battle, without consulting the firemen. And who can justly say that they have not just cause for complaint? What has become of the "twin Bs"?

Firing Anthracite Coal.

LAST PAPER.

Very much of the proper combustion of the fuel depends upon the adjustment of the draft pipe with the low double nozzles. The draft pipe requires such adjustment as to distribute the action of the exhaust over the fire as equally as possible. It is generally admitted that the height of the draft pipe above the nozzles governs the action of the exhaust on the front end, while the space between the stack and the top of the pipe governs the exhaust on the back end of the fire. Sometimes both these conditions can be satisfactorily met with a pipe as furnished, but it is hardly to be expected that a standard draft pipe can be made, that would be suitable to all kinds of locomotives. An adjustable pipe, made so as to slip one part over the other, would seem to be requisite, for then either end could be adjusted without disturbing the other, while with a stiff pipe the proper adjustment of one end might prove just wrong for the other, and then there is no remedy, except by cutting off, or adding a piece. When I first commenced firing, I was put on a locomotive, on which I cleaned the fire from three to seven times a day, with very little steam, and the injector and blower on at every stop A proper adjustment of the draft pipe produced such a change, that I was enabled to fire the same locomotive a whole day without cleaning, and never cleaned more than once a day after this, so it is very evident that a proper adjustment of these parts is of paramount importance to the steaming qualities of a locomotive

A locomotive which has too strong a draft on front of fire will soon kill the fire there by overwork, leaving other portions unburned. The front will require constant watching, and frequent feeding, to keep it alive; but, unless great care is used, it may soon become too heavy there, and when it gets to that condition, she will not steam, through inability to work the fire.

Some locomotives also have a tendency to "haul their fires" This is caused by too heavy a draft on the back end, by which the coals from there are drawn ahead and deposited on the front end, which thus becomes heavier with every exhaust, until she fails to steam. The remedy for a too heavy fire in front is to get rid of it as soon as possible, sometimes it must be done with the packer, but often with locomotives having sliding bars, pulling them out and jumping on these ends will start the fire to running out, and when reduced to the proper thickness, shoving in the bars stops its further exit. While this is being done to the front end of the fire, a heavy layer of fine coal spread over the back end will generally stop the hauling, and, if followed by a layer of lumps, the fireman may be able to gain the victory.

Sometimes fires will be overworked along the sides and "die out"; these spots must be knocked out, and live coals shoved over the grates, and tied down with a few shovels of new coal, fresh coal, thrown into a hole, will not "catch," as in soft coal—it must have live fire under it.

On arriving at the end of the trip, the fireman "knocks out the front end" of the fire, as described for cleaning, and generally also "bars up" the back end (to insure good draft through it), and covers it over with a thin layer (4 or 5 inches) of new coal, and such a fire will last in the roundhouse, without any other attention, for 12 hours, by which time it is presumable the locomotive will go out on another trip. In getting her ready for the trip, the same operation of "shoving the fire down" and working it over, to free it from ashes and clinkers, is performed as in cleaning on the road, with the exception that more care is probably necessary to secure a good layer of kindlings from the coal which has been thus lying inactive for twelve hours. If a locomotive is in the roundhouse longer than twelve hours, with fire in her, it is "barred up," and new coal applied from time to time by those in charge of the roundhouse, who, of course, are also required to attend to the water in the boiler, and keep it at a proper height. VULCAN.

Mr. L. B. Paxon has been appointed Supt. M P. of the Reading Ry. system.

An Injector Suggestion.

While riding on an elevated locomotive a short time since, the writer could not help but notice the attention required to start and stop the injector—they used a Monitor No. 4. The runner not only shut off the ram, but the throttle valve in steam pipe as well. To start he had first to open this steam valve to get steam to the primer, then the primer, then the ram; all this takes time and attention, and it looked to us as if an improvement could be made by using injectors that operate by one lever only. The engine was trying to burn pea coal and the runner had to play with the squirt a good deal to get along at all—perhaps with decent coal a man don't have to shut off the injector every time he tries the gauge cocks. An injector that will start and stop with a single motion of a lever, does not require a man to look away from the track or his signals, and has an advantage over any one that does.

An Electric Brake.

A new electric brake was tried, some time early in January, on the Lehigh Valley road, and the usual glowing accounts given in the daily papers. As now constructed the apparatus is trappy, being on the "grab-and-wind-up" order. The daily paper description is as follows:

"The essential features of this new system consist of a composite sleeve cast onto the car axle, upon which two friction pulleys, properly geared, are thrown into action by an impulse of electric current by which a chain gear is wound and the brake applied. The electricity is stored in the engine and rear car, and carried by insulated cable along the train, with proper couplings between cars. Each car is acted upon independently and instantly, and the train stopped without bumping or any vibration."

There may be a future successful electric brake, but it must be one in which the power is applied direct—not the trigger to release a spring, that releases a dog, that releases a hammer, that descends on the charge, and finally fires off the brake.

The new automatic brake that will supplant the air brake must be a simpler, surer, quicker, safer, and cheaper device than the one we now have.

Richmond Shops of the Atlantic Coast Line.

At the shops of the Atlantic Coast Line road at Richmond, Va., we noticed an improvement in the blow-back pop—a 3-way cock that lets it blow into the air as well as the tank. Mr. O'Brien, the master mechanic in charge, has some of the best looking passenger engines in the South. They are Baldwin 8-wheelers, extension fronts and straight stacks, 18x24. It was found that the first of the series were a little heavy on their front trucks, and the later ones have the air drum on the tank and are lightened up in front as much as possible, a wrought stack base being used.

Mr. O'Brien is applying eccentrics with a 4" face to all his engines. These eccentrics are cast in two pieces that lap by each other, and are riveted together on the axle, making, to all intents and purposes, a solid eccentric.

These engines are provided with Bryant's hose and strainer cleaner, of which Mr. O'Brien speaks very highly. Sellers' '88 injectors are used, and the men like them, but say they do not throw as much water as the '76—it is a matter of record that the '76 Sellers will throw more water than any other instrument of the same size, under varying steam pressures.

This line of road use the Sewell system of steam heaters and use no reducing valves on the steam pipe, but send back 70 to 80 pounds of pressure, in order to run a small engine and dynamo in the baggage car. As might be expected, they have lots of trouble with leaky couplings and ruptured hose.

This road owns and runs the last Norris engine built, delivered in 1865; of course she has had a new boiler and a new set of wheels, but the rest is intact, and all "Norris." The engineers say that, with a train of her size, she can wag her rudder at anything on the road.

These shops resemble a saw mill more than a machine shop, and the tools are in keeping with the building, and it is to Mr. O'Brien's credit that he maintains his power as well as he does, with the facilities at hand. Modern shops, new tools, and a roundhouse are sadly needed.

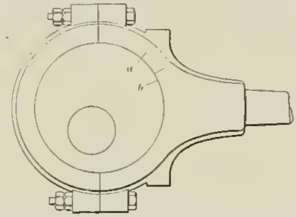
Why Lead Increases as Reverse Lever is Hooked Up.

The reason why the ordinary link motion, or shifting link, employed on locomotives, increases the lead of the valves as the reverse lever is hooked up has often been explained by eminent writers who evidently wrote for the few who were supposed to understand the subject, rather than for the many who do not.

Engineers and firemen, as a rule, are too busy to study these complex demonstrations of a simple problem, and their educations are seldom equal to the problems if they had the time.

Each and every one of them know that the lead does increase as the lever is hooked up, and that this is one of the reasons that the locomotive will run faster, etc., but you pin nine out of ten of them right down, and demand to know *why* the lead increases, and there is not one in one hundred who can give an explanation off-hand. They know they have read so-and-so, and could find the reason in some work. Yet the explanation is simple enough.

Now, if we take a locomotive with ordinary link, and want to increase the lead, we would do it by advancing each eccentric in the direction it is to run. If, for example, we take the R.-go-ahead eccentric and mark it as at *a*, and then proceed to move the eccentric ahead, to increase the lead, the mark would show a break as at *b*. Now, when we hook the reverse lever toward the center, we do not move the eccentrics ahead on the shaft, but we do move the straps back on the eccentrics—which



amounts to the same thing—the lead increasing the farther the lever is hooked toward the center, and the mark would show a break as at *b'*, the same as if the eccentric itself had been advanced on the axle. With locomotives having very long eccentric rods, the lead will not increase so much as with locomotives having very short blades, or rods,—because the short rods make it necessary to move the straps farther around, and back, on the eccentrics, while with the long rods the ends at the link could be raised from six to ten inches without moving the strap on the eccentric but a very little. This is not offered as a substitute for those explanations that describe the increase by the difference in the arcs the rods would describe if they embraced the axle instead of the eccentrics, etc., etc., but as a short, simple, easily understood explanation for practical men.

Get It Right.

The Westinghouse Air Brake Co. have had trouble in the past by the improper application of their brake apparatus to cars and locomotives. Of course, it is of the utmost importance that the best results should be got from their device, and they have followed a sensible course in issuing a circular calling attention to these facts, and end by saying:

"We will be pleased to also provide, without charge, a competent representative to co-operate with your officials in the education of your employes in matters pertaining to brakes, and to superintend their attachment wherever applied.

"In this connection, we would suggest the insertion in your engine or car contracts, when our brakes are specified, that they should be applied to such vehicles in accordance with plans provided by this company."

New Shops.

The Eames Vacuum Brake Company are very busy; they have recently moved into their new blacksmith shop, one of the best arranged in the country. They have 20 fires provided with Sturtevant blowers, and an exhausting fan to clear the shop of smoke and provide pure air. They have also completed a new foundry of modern design.

Correspondence

Setting Slipped Eccentrics.—A Rule(?)

Editor The Locomotive Engineer:

In looking over the November number, I noticed a communication from T. H. E., of Nashville, Tenn., asking for a rule to set a slipped eccentric. Now, I think that the following will be just what he wants, as an eccentric can be set by it in less time than it takes to tell it. First, place your reverse lever clear down in the corner, either forward or back, then get down under your engine, and take pin that goes through the reach and link out, and let your reach down upon the ground, then lift reach up, and you will find that holes in reach and link do not match. Right here is the place where you do your setting; have fireman turn eccentric on axle until the holes match and pin will go back in again, without *prying* or *moving* link, then fasten eccentric, and you are all right. It takes but a second to do this, and if some of your readers should happen to slip an eccentric, I would be greatly obliged if they would try it, and tell us how it works. "SQUAB."

[We are inclined to think this is one of those old rules (?) that are altogether too numerous. Can "Squab" tell us the *reason why?* What makes the link assume its correct position when released from the eccentric that has gone astray? Setting a slipped eccentric is no great feat when one understands how to go at it, and the reason certain things are to be done. Let's see you prove it, "Squab."]

Has Been There Too.

Editor The Locomotive Engineer:

I note in January number of your paper an article from T. B. Livingston, relating to engines carrying water. As I was around Wisconsin in those days, I can say I remember all about the circumstance referred to, of engines 26 and 27, and well remember Mr. Chas. Morse, and I think I can go a little further than friend Livingston has in this subject, by bringing in Mr. Geo. T. Thompson's name as having claimed just as Mr. Morse and friend Livingston has.

I only mention this to give proof that the circumstances were known to me, and if these few lines bring out any discussion on this subject, I will, at some other time, give my experience of a similar nature, on a *Gould* engine, in 1857, on the then Milwaukee & Mississippi R. R., now the Prairie du Chien division of the St. Paul Ry.

Should this come to the eye of T. B. Livingston, he may be pleased to know I am still among the living, and following about the same line of railroad life I have, for the past twenty-five years.

K. C., Ft. S. & G. R. R. H. BATES.

Revenge is Sweet.

Editor The Locomotive Engineer:

I cannot pass unnoticed your criticism of the Erie R. R., in abolishing the office of M. M. Your criticism may be all right so far as it goes, but if this move of the management upsets the pitchforking that has been in vogue on the Erie and some other roads that I have worked for, then I think it is a God-send.

You won't print this, as it's against your teaching, neither would I care a tinker's dam if you did, as I don't railroad now. HUGH CRUMLISH.

Buffalo, N. Y.

[THE LOCOMOTIVE ENGINEER does not exclude any man's opinions because they differ with our teachings or anything else. We oppose the placing of the motive power out of the hands of mechanics, and the reduction of the hours of labor and the number of men employed, and the reduction of the pay of those finally left in the ranks, simply because it is dangerous to the lives of the enginemen and the public. The engineers and firemen of this country are running enough of neglected engines over uninspected track and rotten bridges. Any railroad that deliberately lets its motive power and permanent way drop below the safety line ought to be closed up by law. We make men have their boilers inspected, to keep them from endangering the lives of the public, but we let a few gamblers send out the order that passenger trains must run over hundreds of miles of track that is not cared for and drawn by locomotives that are not kept in safe running repair. It is inviting disaster.]

Opinion of a Manufacturer on Railroad Papers.

Editor The Locomotive Engineer:

I thank you very much for your kindness in sending to me back copies of your paper. I am an old "railroader" myself, having put in twenty-five years of my life in the service, and have, during that time, read, of course, many so-called railroad papers. It was not until recently (having been for the past five years out of the service), that I have seen your paper, but I must say, and with no desire to flatter, that I consider it the best railroad newspaper I have seen.

The fault with most railroad newspapers is that they are "filled in," in great part, with extracts from railroad reports, and all the floating "flotsam and jetsam" which they clip from the daily newspapers, and from their railway exchanges (each from the other), and from every source they can lay hands on.

Your paper is largely original, and with common-sense matter from practical railroad men. It does not come too often (once a month is often enough, a large weekly railroad paper is a bore), and when it comes it is clean and clear. I enclose $1 for subscription for one year from January 1st, and will thank you to give me your lowest rates for advertising.

With best wishes for your future success,

131 *Rittenhouse St.*, J. H. BURRELL, JR.
Germantown, Philadelphia, Pa.

Good Report from the Triple Expansion Exhaust.

Editor The Locomotive Engineer:

Your favor December 13th received. In reply I will say I have been using "Smith's Triple Expansion Exhaust Pipe" in a Baldwin "Mogul" engine. We have had considerable trouble with these engines, from their not steaming well. Since applying the device we have had no trouble whatever, and the engine will haul from three to five cars more than other engines of the same class. I consider it a first-class invention, and that it accomplishes something which we have been trying to overcome for many years—back pressure, and I am satisfied that it does it effectually.

A. W. QUACKENBUSH,
Gen'l M. M. Wabash Western Ry.
Moberly, Mo.

A Few Inconsistencies with a Kink.

Editor The Locomotive Engineer:

Mr Editor, in the ante bellum days, when you used to do the grand, right-hand act on a wheezy smokingine, did you ever stop at a station, say, for example, Tarryall—where you expected to meet the "howler"—with a freight train, a slow conductor and a fast speed recorder, at exactly 2.01 P. M., by the steelyards, and have the telegraph "operation" come out on the front porch and give you frantic signals to come ahead, and wave aloft a yellow order like the traditional reprieve—just in time —and then get an order, saying that by the order of the dispatcher and the grace of the train master *et al.*, you could have until 2.7½ to get to McGlory, 10.3 miles away, and up a 3 per cent. grade, regardless of the "howler."

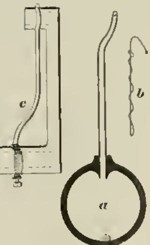
You have? Well, did it ever dawn upon your benighted intelligence that such an order made it any easier for you or your old cob-chopper to get in on the turnout at Tarryall, and wait 2 hours and 37 minutes for the howler that was trying to howl with thirteen sleepers on an engine that was built for four?

Kinder sort o' inconsistent, ain't it? Simply a reminder that the dispatcher is not so very sound asleep.

Now, that order is just as consistent as it is to put an oil-cup on a brass plug, brazed onto a copper steam pipe, to the air pump, *and not punch a hole in the pipe;* but that is just what I found on one of our scraps the other day, and she had run a year that way, *with a sight feed cup on, too!*

Once upon a time I fired an old hook motion, whose right pump wouldn't work, because the tank valve was not attached to the rod, *and never was!*

A few years ago I got 90 days leave of absence—called division superintendent a liar—and went West to grow up with the real estate, etc. Got a job on a mountain road, and was given a consolidation scrap with a driving brake rig right in front of her links; she was new, or rather just out of the shop, and the first thing I did was to get the lower end of a link hanger hot, because it did not get oil —expected one to oil a hole thirty-six inches away, with an old, free-for-all oil-can, with a fifteen-inch snoot. Another case of inconsistency.

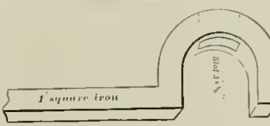


I run several of these boats, and will bet four dollars that the lower end of hangers did not get a drop of oil in a hundred miles, and couldn't have kept it if they had, and three drops was all they needed.

I went to work and made a ring like the sketch, *a*, and soldered a ¼ inch copper pipe, *c*, into the top, long enough to come up to top of hanger, and sticking through into the ring ¼ of an inch; this and the solder around it being filed down, so as to enter the countersink of oil-hole. The set screw below would hold the device in place.

I bent a wire, as shown at *b*, and put a couple of inches of woolen yarn in it, and this I shoved down in the top; the space above it would hold, say ten drops of oil, and would feed all day. If cinders got in the mouth of pipe, or I wanted to put a lot of oil directly over the bearing, I pulled the wire out. I could easily change the rig from one engine to another. It did not cost much, and was good in its place.

There ought not to be a place for such kinks, but unfortunately there is. JOHN ALEXANDER.



Keeping Air Pumps in Service—Relyea's Tool for Hose Head Repairs.

Editor The Locomotive Engineer.

The hints on air pump repairs in November paper, by William Foster, are very good, but if he has as many pumps to care for as we have here it must keep him moving to change pumps every time they "kick up." Mr. Foster says: "When a pump refuses to work there must be something radically wrong with it." I don't think so, because there are many simple causes for pumps refusing to work, for instance: the exhaust pipe in front end sometimes gets stopped up with cinders, when the pump makes one stroke and stops; again, if the oil-cup don't feed, or the engine raises her water, so that it works through the pump, it will stop it, so if a pump refuses to work it does not follow that there is something radically wrong with it. When a pump is reported to me as working bad, if the engine has steam on I start the pump, locate the difficulty, and repair it; or if the engine is dead, and the engineer tells me how the pump acts, I generally find the trouble and overcome it without taking off the pump, thereby saving time and labor.

"Keeping the same proportions" is all right in general repairs, but in ordinary repairs I think we can deviate a little without affecting the working of the pump very materially. For instance, I have had pumps that were in good shape, except that the upper and lower main steam valve bushes were worn to a shoulder; in such a case I have a fluted reamer, about two inches long and $\frac{1}{32}$ larger than lower end of main steam valve; this reamer I screw on the end of a long arbor, and with a small ratchet ream out the shoulder worn in the lower bush; the upper bush I take out and chuck it in the lathe, and bore out the shoulder. By doing this I get another year's work out of the pump, and it works just as well as if I had put in new bushes.

With a good lubricator and proper care, an air pump ought to run two or three years before it needs a general overhauling. When the rubber packing ring in hose couplings wears out I put a new one in without taking the hose off. To do this I use a tool like the drawing. If any of your readers, having any of this kind of work to do, should make one, they would soon "get on" to the manner of using it, and would like it. I put the coupling in the hook, which has a slot in the curved part to admit the projection on the end of the coupling head, this tool, or hook, is about three feet long, and by holding the coupling and hook in the left hand, and letting the lower end of it rest on the floor, I take an open wrench in the right hand and unscrew the cap very easily.

"Snooks" says he is stuck on his first air pump; I have had pumps act the same as his does. The causes were a loose reversing cylinder, or bad joint on top of reversing valve-bush. I am very much pleased with the improved appearance of THE LOCOMOTIVE ENGINEER; success to it.

W. F. RELYEA.
Syracuse, N. Y.

Cab Fixings.

Editor The Locomotive Engineer:

Of all the lamps on the engine, the gauge lamp is generally the worst. It has a glass globe on it, which is painted on the inside, and is smoked up so black, that what little light is made by the flame is absorbed by the black surface and never gets out. The oil tank is filled with lard or sperm signal oil, so the wick has to be turned or picked up about every two hours, and on a long, all-night run, the oil is burned out before daylight, so it has to be filled fresh. Some of these dandy lamps can be found with your nose before you can see them, as they make more of a smudge than a light. Some of them have fancy brass bottoms that have been in two or three smash-ups, and in the tinker's hands at least twenty times.

If the boys who have one of the above described lamps on their engine want solid comfort, let them clean the globe of all paint, pictures, and dirt on the *inside*, and paint it white on the *outside*, about two coats, and after that is dry put on one coat of green. When this is dry it will be just as smooth as the glass. The white paint next to the glass will make a reflector, and what light is made by the flame will be utilized.

After the paint gets dry set the lamp up where it belongs, scrape off the paint, so the light will shine through a hole about the size of a silver dollar, on the steam gauge, another small hole to let the light on the air gauge, one for the clock, if there is one on the engine, a big one to light back into the tender, and, if the lamp comes in the right place, a little hole in each side will light up the tallow cups for the valves. Try it, boys, and see how much better it is. Fill your lamp with kerosene oil, use a small burner and narrow wick, and you will be surprised to find that a flame no larger than an ordinary steel pen will light your cab, and not smoke, but burn all night without picking up.

Sometimes, when you get down to oil around, the torch is so big that you can't get your hand around it and the oil can both, and the torch drops to the ground. Get a smaller piece of pipe next time for a torch. The wick drops down into the torch most every time, and leaves you in the dark. When you get in, take your torch to the man who runs the little lathe, and get him to cut a fine ragged thread from one end of the wick tube to the other. This will catch the wick so it is not apt to fall down, and a much looser one can be used, which gives a better light, and don't blow out so easy.

If your dripper is so made that, when you try your gauge cocks, the dirty water splashes up on your side window, and all over the side of the boiler, get a piece of brass wire gauze, as long as the slot in the top of the dripper and wide enough to roll up and fill the dripper full, squeeze it into the dripper, and when the water strikes the brass gauze it will go through and stay there. Don't put iron gauze in, for it will rust out in a week.

Lansing, Mich. CLINTON B. CONGER.

More Proof of Water Splitting.

Editor The Locomotive Engineer:

I am a reader of your valuable paper, and I think it the boss paper, and if more of the enginemen would read it they would be better posted on a good many points. I saw an article in your last paper, about steam splitting the water in boilers. I want to put my experience alongside of those other *cranks* (at least that is what the others call us). I commenced running an engine on the old T. H., A. & St. Louis road, in 1857, and almost the first engine was a McQueen, 5½" wheel, 16 x 22" cylinder, pulling freight. I asked the man that I took her from why she was on freigh; the said, "She is a tough cuss, but don't be afraid of her, no matter if you can't find any water in her, if the pump works well." Well, sir, I run her one month, and there were times when she would have plenty of water one minute, and the next not a drop to be found in any of the cocks. Another time, plenty of water in the two first cocks and none in the third.

That engine had run on that road over a year in just that way, and she never leaked a drop of water that I ever heard of. She was given to every new man that went there to work. I was there three years, and she never played out on account of low water. There were two others there of the same class, that were all right as far as the water was concerned. I never met the man that could tell why it was thus.

I have served thirty-one years and seven months on the foot-board, and that is the only engine that I ever met that I did not know whether I had water in her or not. I have seen three minutes pass, throttle open, working hard, and not a drop of water in sight—and I never was drunk in my life.

Meadville, Pa. C. M. SPOFFORD.

Another Good Driving Spring Kink.

Editor The Locomotive Engineer:

Having given you a description of the device we use for the removal and replacing of back driving springs, which I see you have illustrated in your November issue, I wish to ask you if you will please explain to the boys an appliance we have for the removal of front driving springs. It will readily be seen that the jack used for removing back springs cannot be used for the removal of front springs, owing to the lack of space between the top of front spring and boiler.

I have removed front springs by the use of a chain and bar. Have also used a jack with chain attached to it, but I have known several cases where men have been injured by the chains breaking.

To avoid this danger, in place of chains I use iron strips ½" × 2", *A*, Fig. 1. These strips are each in two parts, the longer piece being offset to receive the shorter one, which, when they are pinned together, leave the inside faces parallel when placed in position for removing spring.

By drilling three holes in each piece these strips can be lengthened or shortened, as the different builds of engines may require.

The long and short parts of each strip are pinned together with ⅞" × 1½" steel pins, through the ends of which ¼" spring cotters pass. The lug *B*, Fig. 1, is jumped on to the face of the short piece, as shown by cut. Both the upper and lower edges of this lug should be rounded, as should be also the upper part of the slot through short piece *C*.

The crosshead, *D*, through which the screw passes, has a 2" face, as shown at *E*, Fig. 1. The wings of this head have ⅞" × ½" slots cut in them, as shown, to receive the long strips.

The screw has square thread, is 1⅞" × 8½" with a tempered steel point.

A forward driving spring is removed with this device as follows:

First jack the engine up until most of the weight is removed from the springs, then pass the strip to which the lug is attached up on the *inside* of engine frame, and hook the lug over the top of spring, as far forward as possible. Now pass the other strip up on the *outside* of engine frame, between driving wheel and frame, and hook it over end of lug. To prevent the apparatus from slipping down the spring towards the band, place a stick of the required length between the band and lug, as shown at *A*, Fig. 2. After having placed this stick in position, hook the wings of crosshead through the square slots in lower ends of strips, and pass the screw and crosshead back under the pedestal brace, as shown in Fig. 2, and apply the point of screw to brace.

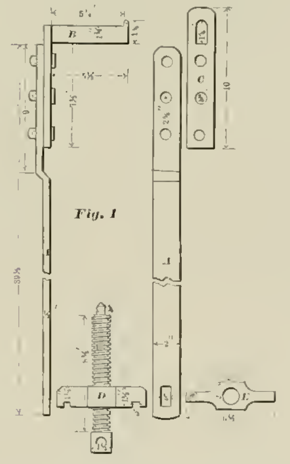


Fig. 1

This appliance is cheaply made, and there is no danger of it slipping or breaking, and injuring a person.

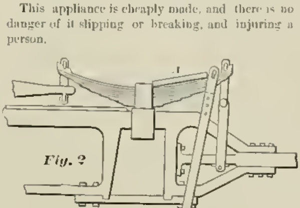


Fig. 2

I give this to the boys for what it is worth, hoping that some one, through your good LOCOMOTIVE ENGINEER, may derive some benefit from it.

Minneapolis, Minn. L. C. HITCHCOCK, "Soo" R. R. Foreman.

A Protest Against White Switch Lights.

Editor The Locomotive Engineer:

One of the most important factors of safety in the movement of trains is a means of readily detecting a misplaced switch. This is provided for by connecting targets with the switches in such a manner as to indicate the position of the switch, either by the color or the shape of the target, or its position in relation to the frame of the switch. At night, however, it becomes necessary to have lights in connection with the switches, which shall be so connected as to show at a glance what the position of the switch is, unless, indeed, it should be the policy of the company to "go it blind," as is the practice on some roads. A switch light seems, however to be a usual adjunct of every switch leading from or to the main track of nearly all roads of the country. In nearly every case, a lantern with plain red and green glasses is in use, and seems to give satisfaction, because a green and a red light are readily distinguished, and would seem to leave nothing more to be desired. Of late, however, some roads are using a white and red bull's-eye lantern, whose use will prove fraught with danger, and, as there are enough risks in a railroad man's life, all unnecessary elements of danger ought to be protested against, and, if possible, eliminated from the service. These bull's-eye switch lights, having concentric circles, serve to disseminate the rays of light in such a manner as to leave a person approaching them in doubt whether it is an extra bright switch light or a dim headlight which he is looking at. Again, on most roads track-walkers make their rounds at night or in the early morning hours, and carry white lights. Most roads are so crowded with business that trains follow each other very closely, and are liable to overtake each other whenever the one fails to make time, from any of the numerous causes which "lay the boys out", this brings, or ought to bring the flagman out, and as they always carry a white light, and in many instances are careless in the manner in which they carry the red light often having both lights in the same hand), we have a condition of things which is liable to lead to disaster. When an engineer sees one of these bull's-eyes at a distance, he has to guess whether it is the switch light burning all right, or a train approaching him with a poor headlight, or the track-walker who has given his lantern an extra trimming, or a careless flagman who is hiding a red light behind his white light. He is therefore "going it blind" for awhile, until he approaches near enough to properly classify the light. Another point is that most of these bull's-eyes are trimmed up so high, and throw so much light as to dazzle the eyes for a moment after passing, and that a red light is hardly discernible, if held in line of vision behind a white bull's-eye.

With all these points of danger, the prayer of all railroad men should be: Save us from all these white bull's-eyes, and give us a plain red and green switch light, for the green is so different from all the other lights, so mild to the eye as not to dazzle, and so readily distinguished from the red. The red can also be seen to a much greater distance, when used with a green, than when in company with a white light. VULCAN.

More Evidence.

Editor The Locomotive Engineer:

In the January issue of the ENGINEER, I see a correspondent from Wisconsin asks in regard to engines splitting their water.

I have had some experience in that little matter, and I cannot say that I was any better pleased at the time than the man from Wisconsin.

It used to be quite a common occurrence on the Atlantic & Pacific R. R. but I cannot say how it is of late years, as I am told they have much better water there now than when I was there. It would most certainly be very easy to burn an engine under the circumstances, but I never heard of its being done, although a great many engines were burned there about 1880 and 1881.

At that time there were quite a number of engineers from Boston running there under contract for a year, and they did not understand handling poor water.

The M. M. used to say that if they wanted to send Boston men out there, they ought to send Boston water with them.

The water was so bad that if you could see water in lower nut of water glass when shut off, you had a great plenty in the boiler, for when you opened the throttle and commenced to work your engine, you would see the water going out the stack. The boiler had to be blown out at every water tank, and washed out at both ends of the division.

The boys used to say they had a disease called "the long neck"—stretching their necks looking for water in bottom nut to water glass. "She was a daisy." MC.

Colorado Springs, Col.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIR

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CONTENTS.

On Designing Pea Coal Burners for the Elevated Roads.

With the failure to burn pea coal in the elevated engines, comes the news that officers of several surface roads that do burn this fuel have made the assertion that they, or some of the mechanics under them, could design engines, or boilers, for this service that would burn small coal.

General Manager Hain will, no doubt, give them all a show, but reminds them that the engines must not weigh more than 23½ tons, including 600 gallons of water and 1,800 pounds of coal, and have a wheel base not to exceed 16 feet, and be able to haul 5 car trains, each car weighing empty 23,000 lbs., containing 100 persons each, up grades of 2 per cent. and around curves of 90 feet radius, stopping and starting every fifth block, and making an average speed of 15 miles per hour. Not so easy as it looks.

Manager Hain is a practical mechanic, and was for many years a master mechanic; he commenced his railroad career on the Reading, one of the first, if not the very first road in America to burn anthracite coal. Mr. Hain has designed and had built under his supervision more than 1,000 locomotives, mostly hard coalers, and a few years ago was sent by the Baldwin Locomotive Works as an expert to Russia, to test the hard coal there, and design engines to burn it, which feat he accomplished with honor to himself and his employers. When any of these latter-day, hay-wagon, fire-box designers pose as experts, we would remind them that General Manager Hain is himself an expert of a high order as is also his general superintendent, John Campbell, to whose mechanical ability, as general foreman of the L shops, is due the present high performance of their engines, and who knows more about what these engines have done, can do, ought to do, and cannot do, than any other man in the employ of the Manhattan or any other road.

End of the Strike.

The great strike on the "Q" is over. It is doubtful if either side would repeat it under the same circumstances. It has hurt the road, crippled its motive power, undermined its business, and cost it well up in the millions of dollars, and ends by its officers agreeing not to become criminals by black listing the former employes. To the engineers, firemen and switchmen it has been a lesson, and has taught them several things that will make the orders all the stronger for the trial. Firstly, it has shown that strikes do not pay, that violence will always be attempted in every strike and the strikers blamed for it. It has shown the very bad method of distributing money to strikers—which can be remedied. It has shown the engineers that the firemen are men of their word, and honorable to the last degree, fewer firemen having become scabs than engineers; this lesson has long been needed. It has shown organized labor, far and near, what organizations can stand in case of trouble; it has shown that it is better to surrender half licked than to fight it out and get licked anyway—75 per cent. of the men were offered jobs in the proposed settlement, six months ago.

It seems to us that many brotherhood engineers will recall the fact that, in the eleven years that their grand order won its great name, the confidence of the public, doubled the pay and broadened the privileges of its members, that it had no standing Grievance Committees. Able men as officers, with power to act for the men, have been able to do much for the orders by diplomacy; the committees accomplish little by force.

It will take the road years to recover its losses; the orders will recover all losses in a year, but individuals will suffer longer.

Honest Work.

Clinton B. Conger, our correspondent, has been reappointed mechanical engineer by the Commissioner of Railways of Michigan. Gov. Luce evidently appreciates the work done by Bro. Conger in the past, for in his message to the Legislature for 1889 he says: * * * "In 1887 the Legislature authorized the Commissioner of Railroads to appoint a mechanical engineer as an assistant, whose duty it should be to examine the condition of engines, frogs, guards, switches, bridges, etc. The appointment was made, and I believe has been a great benefit to the roads, and to the employes.

"No difficulties have arisen in our State between companies and men, but, with such a vast system and army of employes, we are warned by experience that there is always danger of troubles and conflicts. The Railroad Commissioner mediates between the public and the companies, and it has been suggested that he and the mechanical assistant be authorized to aid in adjusting troubles, should they arise, between companies and men. And I commend to your consideration the propriety of constituting these officers a Board of Arbitration in company with some one to be selected by the company or companies with whom conflicts may arise."

Possible Cause of Granger Legislation.

Some time since a fit of dividend-requiring economy took off most of the mechanics and laborers on the N. Y., Phila. & Norfolk road. The management seemed to think that section men were an unnecessary luxury, even at a dollar a day, and now the low joints and high centers make the average passenger think he is a deck passenger on a Connecticut tin wagon. We observed that the engineer, on one engine at least, had to run with his hand on the starting lever of the Sellers' '76 injector—the track was rough enough to break it every few minutes. If such management (?) were risking their own lives alone, we would bid them good-by with a "Godspeed", but it is the employes who must toil for bread, and the unsuspecting passengers, who take the risk. It is no wonder that some of our roads have a chance to cry Granger legislation.

Price *vs.* Quality.

Mr. F. H. Stillman, of the well-known firm of Watson & Stillman, manufacturers of the Vreeland Transfer Jack, and other hydraulic machinery, has been appointed purchasing agent of the Gulf, Atlantic & Havana R. R. The road is a small one, as yet, but is liable to need considerable equipment, including a half dozen locomotives. The selection of a mechanic, instead of a cousin of the general manager, for the position of purchasing agent, is in the right direction. A mechanic usually looks to quality first and price afterward, instead of price first, last, and all the time. What our railroad equipment wants, is more quality and more price.

A Reform Needed.

When a railroad official so manages, or mismanages, his department as to make every employe uncertain of his position, dissatisfied, and under so many adverse rulings that they hardly know the official interpretation of rules and orders, that official is incompetent for the work, or the work has grown beyond his ability.

Such a feeling of general dissatisfaction the writer found on the D., L. & W. road, on a recent trip out of this city. Inquiry proved that the cause of all this was the alleged "pernicious inactivity" and unfair rulings of Supt. Andrew Reasoner, at Hoboken, N. J.

The men claim that Mr. Reasoner is no reasoner at all, that he punishes different men for the same offense, where one must be right and the other wrong; that he keeps men off, "pending investigation," for months at a time, and that he hears one side of a story and not the other—that, in fact, he is judge, jury, and executioner. And they cite more than one case to prove their assertions. If the facts set forth are true, and they appear to be, the men have just cause to be dissatisfied.

They say that some time since engineer Isaac Shields was pulling a freight train on a very foggy evening. He was hurrying away from an approaching passenger train, but this train got to the end of its run at Dover. On reaching Dover and doing their work, Shields got a signal to go, and he proceeded to the next station, where he found he had not got all his train. The caboose and several cars ran back to Dover—with no one on them—but did no damage. The conductor, rear brakeman and engineer were taken off, and Shields was kept waiting for a decision *for more than three months*. It was not Shields' fault if the conductor and brakeman were not on the rear of train; it was not his fault that it was so foggy that he could not see his tail lights, yet he was punished, and severely; for at the end of three months he was ordered to go to work *as a new man*. The trainmen were off about the same length of time.

Again, on Dec 6 last, a freight train broke down on the road, and the flagman stopped a following coal train. The head train was standing around a curve that went onto a drawbridge; when the train was ready to go the flagman came to rear of car and signaled engineer Weiler, of the coal train, to come ahead, and the caboose disappeared around the curve. The head train moved less than 200 feet and stopped again, the coal train moved 1,200 feet and struck the caboose—*with no flag out*. Had the flagman walked 100 feet, the coal train could have been seen before it started; little damage was done. Mr. Reasoner ordered the men off for investigation, he heard the conductor's story and the flagman's inside of a month, but he made five different appointments with engineer Weiler, and the latter made five round trips from his home at Port Morris, 500 miles, *and then was never allowed to tell his story*. About the middle of January he ordered Weiler put back to firing, and the crew are still off. Mr. Weiler did not go. Any railroad man would say, as do the D., L. & W. men, that the flagman was to blame, and if he was, Weiler was not. Both are not at fault.

Such work as this makes life a burden to conscientious railroad men, who above all things, want fair play. Why the engineemen of this road do not demand some remedy for this evil is more than we can understand, they must have a world of patience and forbearance. Such work would run against a snag in the West.

Pittsburgh Locomotive Works.

The Pittsburgh Locomotive Works built 96 locomotives during 1888, and rebuilt 14. Most of the new engines were very heavy ones, weighing upward of 50 tons each. These works were established twenty-two years ago, and during the first ten years built but 350 locomotives, many of these doing the works more harm than good, as they were so illy designed as to hurt the reputation of the makers. The writer is familiar with one road that had a few of them, and they had boilers but a little larger than the cylinders. No one would run one if he could get out of it, and the very name "Pittsburgh" was enough to give an engineer or fireman the chills.

Twelve years ago the works were shut down half the year, and the business of the concern at low tide, when the services of Mr. D. A. Wightman were secured as superintendent; he at once commenced to build locomotives of good design and put up in a workmanlike manner. The reputation of the works came up, old buildings were replaced by new ones, old tools went into the cupola and new ones stood in their places, until to-day these works are as modern and as complete as the best.

Now comes the announcement that the company will at once put up extensive buildings, and raise the capacity of the works to 250 to 300 locomotives a year.

The splendid reputation and success of these works are due entirely to the mechanical ability of Supt. Wightman.

Suburban Iniquities.

Everyone who knows anything about it, knows that the suburban train arrangements of American cities are notoriously inferior.

Trains that are run in competition with other roads are, as a rule, well equipped, on time, and moderately fast—to hold the trade. But suburban ticket buyers are, in a measure, helpless; they are the under dog in the fight, and the companies follow Bill Nye's advice, and "never strike a man when he is down—jump on him."

New York has the largest suburban traffic of any city on the continent, if not in the world, and the power furnished, cars used, and time made on a majority of the lines would disgrace the most countrified road in the country.

The trains are over-crowded, the engines small or old, and the speed well-nigh unendurable.

On half the roads a crowded train of commuters will start out and poke along at about twenty miles per hour and spend five minutes at every stop, and stop as often as possible.

Trains that are known to be almost entirely filled by people, for a town 30 miles out, have to stop to let off three or four persons for intermediate towns, and before they reach their destination take a siding and let an express by, that left town twenty or thirty minutes behind them.

What good reason is there that suburban trains should not make express time and make no stops?

Why cannot a train be made up to drop cars at stations?

Now the trains stop, the brakeman crawls under, cuts the hose, and then yanks the coupling apart, unlimbers the bell cord, and yells, "All right here." then the switch engine comes out and puts the car away, this delays five hundred passengers, is expensive, and in the way of express traffic

If the brakeman could disconnect the hose and uncouple the cars on approaching a station where it was desired to leave a car, and had a valve arranged at hand so that he could reduce the air in train pipe, thus setting the automatic brake at will, the car could be dropped from a fast moving train, and, with the help of a switch tender, thrown in safety onto a side track, and stopped either by the hand or automatic brake.

With a reliable man on each car, and two brakes at his command, there need be no fear of the car. Some may say it would be risky, but it can be no more so than stopping a whole train in front of an express to take a siding. What stands in the way of its success?

If all commuters in New York city could be assured that they could go home on an express train every day, the majority would feel just as if they had found a ten-dollar bill.

The long pending suit of Craig *vs.* Hodges & McCoy, which is really Craig *vs.* the Detroit Lubricator Co., for the control of the foundation lubricator patents, described by the Commissioner of Patents as:

"The combination of a lubricator provided with a sight feed, or observation chamber, in which oil rises through water in its passage to the discharge conduct for leading such oil to the part or parts of the engine to be lubricated, with a conduct to lead steam from boiler into condenser of such lubricator, and with another conduct within to lead steam from such condenser into the said oil discharging conduct,"

Has finally been decided in favor of Craig; in this decision the Commissioner reverses his former decision.

At the shops of the Atlantic Coast Line, Richmond, Va., we recently saw a piece of the plating of the Confederate ram "Merrimac," that showed a hard knock by one of the solid shots thrown from the "Monitor" The Tredegar Iron Works at Richmond rolled these plates, and the Old Dominion Iron and Nail Co. recently purchased the wreck and are cutting it up. Benjamin S Herring, who has been for some years a master mechanic on the Mobile & Ohio, was chief engineer of the "Merrimac" when she fought the "Monitor" in Hampton Roads.

At the coroner's inquest into the death of Conductor John C Ryan, killed in the railroad collision near Columbia, Pa., January 22, William Rogers, engineer of the colliding engine, admitted that he had fallen fast asleep, as had his fireman, and was only awakened when too late to avoid the collision. The verdict was that the accident was caused by Rogers sleeping at his post. He had been on duty sixteen hours.

We are indebted to Jno. Shields, M. M., for a photograph of a snow plow at work on the Mineral Range Railroad, of Mich., and also of a wreck on the Hancock & Calumet. Of the last affair a local paper says that Mr. Shields and his men replaced the turned-over engine and tender, and had them running between 1 and 7 P. M.

Books Received.

KINNE'S IMPROVED ENGINEMEN'S GUIDE, TIME AND POCKET BOOK Geo R. Kinne, Hornellsville, N Y

This work is issued by Mr. Kinne, who is traveling fireman of the Erie road. It is got up in a very neat pocket form, bound in red leather, with pocket and pencil. The main part of the book is blank sheets to keep time on, and have spaces for date, number of train, engine number, miles run, time allowed, name of person keeping the book, of conductor of train, and from what and to what station run There are blank leaves for memoranda in the back, and pages for keeping a cash account, and is very handy for any railroad man to have in his pocket. In the front there are some short rules about firing and handling engines, care of different kinds of brakes, the standard signals, and considerable other data, good, bad, and indifferent The explanation of an injector is, to say the least, original Were we firing an engine, we should have one in our inside pocket. It is worth something to know what you have done at the end of a month or a year The price is not stated

PIG IRON Including the Relation between its Physical Properties and its Chemical Constituents By Alex E. Outerbridge

This illustrated pamphlet is an extract from a lecture, delivered before the Franklin Institute, Phila., in 1888. Mr Outerbridge's position as chemist for seven years at the great wheel foundry of A. Whitney & Sons, has given him unusual opportunities for observation and research in this particular line.

COMBUSTION IN LOCOMOTIVE FIRE-BOXES. By Angus Sinclair. National Car and Locomotive Builder, publishers, 140 Nassau street, New York.

This little work of 21 pages is a plain elementary treatise on combustion, written for the average fireman and engineer, and in language they can understand These little books have been issued to the firemen of the N Y, L. E. & W Ry, and a circular accompanying reads:

"I take pleasure in presenting to you, with the compliments of the company, this treatise upon the consumption of fuel by locomotives, which has been prepared by Mr Angus Sinclair, the author of several works on locomotives, editor of the *National Car and Locomotive Builder*, Secretary of the Master Mechanics' Association, and for many years a locomotive engineer

"The economical and efficient consumption of fuel is one of the most important objects to be considered in operating a railroad, and the fireman who gives it the closest attention produces the best results. It is the policy of the company to promote its firemen to engineers as rapidly as the service admits of it, and the record made by each fireman in handling fuel will have great weight in selecting men for promotion to the position of engineers This treatise has, therefore, a personal interest for each fireman, and I trust that you will study it carefully and endeavor to profit by the information therein given

Yours truly, ROSS KELLS,
Superintendent of Motive Power"

Other roads might do something in this line with profit to themselves.

ASKED & ANSWERED

(6) E. C. S, Chuluota, Florida, writes:

My engineer requests me to ask the following: His engine, a Brooks mogul, 32-inch gauge, both while running ahead or backing up, runs to the left-hand rail. What is the cause? He says the left-hand journals are the smallest. *A*—If the engine is low on that side it will cause the crowding, as will also a difference in diameter of wheels or improper tramming; these defects must be remedied early, as, after the tire is worn down near the flange, it is difficult, if not impossible, to make them run on the rail any other place

(7) Jas. Mellen, Peshtigo, Wis., writes:

I am running a wood burner with a balloon stack, but do not like it. We had a straight stack with netting in front, but she threw too many sparks. Do you know of any good plan for wood-burner stacks? *A.*—In burning wood it is necessary to provide a large area of netting, in order to hold or break up wood sparks, the mesh should be as fine as 8 or 10 to the inch, and, in order to allow air enough to pass through, it must have a large area The straight, open stack, with a basket net inside, is the best thing we know of. Perhaps your trouble is on account of size of openings in screen

(8) F S E., Elizabethport, N. J., asks:

What is suction? Is the suction of a pump the same as that of an injector? *A.*—Suction is a name given, in mechanics, to a partial vacuum, however formed. The action of a pump plunger exhausts the air in the barrel and chamber, thus producing a partial vacuum; the pressure of the atmosphere then forces the water into the pump to fill this space The action of a jet of steam escaping through or across the open water pipe of an injector produces a like vacuum, and the water is pushed in to fill it. this is called suction. The means employed to produce a vacuum, or suction, makes no difference with the suction

(9) J. W Debolt, Lufkin, Texas, writes:

Supposing we have three wheels keyed on an axle, the two outside ones larger than the center one, and all placed on rails, the center rail being elevated to make up for difference in diameter of wheels, would there be any slip in the middle wheel in revolving? If so, please explain. For example, the outside wheels are six feet, they would make three times and a fraction of the diameter in one revolution, and the center wheel was only two feet, it would make only one-third the same lineal measure I claim that in the little wheel working from the center of the axle there could be no slip. *A.* If more than half the weight of the three wheels and axle were on the outside wheels, the center one would have to slip; if it carried more than half the weight it would slip the outside wheels Try it with a spool on a stick.

The Locomotive in America.

BY WILLIAM BARNET LE VAN

SECOND PAPER.

The first carriage propelled by steam in America was the "*Oruktor Amphibolos*," or amphibious digger, designed by Oliver Evans, the first regular steam engine builder in the United States.

In 1804, the Philadelphia Board of Health ordered of Evans a steam dredging machine for cleaning the docks of the city. The dredger, when finished, was named by Evans as above, and he determined, when it was completed, to propel it from his workshop to the Schuylkill river, which was successfully done—to the astonishment of a large crowd of people gathered together to see it fail. Before launching, July, 1805, the machine was run during several days around Centre square (the place now occupied by the Public Buildings). Finally the dredger was launched at Market street wharf, Schuylkill, and the engine having been connected with the paddle-wheels, she steamed down the river and up the Delaware to her dock.

The high-pressure engine was applied to turn the wheels of a carriage that carried boiler, engine, etc., the object being to use steam power to turn the wheels, and thereby haul other carriages carrying loads. In plan and principle, the parts and combinations included all that is essential to the locomotive as a tractive, motive power.

The results of the experiment made by Evans were not of a character to make the locomotive date from his acts, but was the step or entering wedge towards the use of locomotives.

The boiler used was the same as was used for driving his high-pressure engines in 1780, and was a multi-tubular boiler, but differed from the present boiler now in use by having the water in the tubes, in place of around them. The Cornish boiler with one flue and the Lancashire boiler with two flues were both invented and used by Oliver Evans.

Peter Cooper, of New York, deserves the honor, among the other honors of his useful life, of being the first to introduce into actual service the locomotive in America

In 1828, Mr. Cooper was in business in New York city, his native place. His mother and grandmother were both born on the present site of St. Paul's Church, Vesey street and Broadway, and his mother remembered seeing the stockade still standing, which had been erected to keep the Indians out of infant New Amsterdam. Mr. Cooper had bought as a speculation the entire magnificent tract of land in Baltimore, now owned by the Canton Company. Baltimore was then a city of 75,000 people, rich and prosperous, and had entered upon the railroad era. On July 4th, 1828, the corner-stone of the Baltimore & Ohio Road was laid, with imposing ceremonies, by Charles Carroll. It was pushed energetically—a little too much so, in fact, for, when *thirteen* miles had been finished, it was found that the short curves around the rocks to save cutting could not be used, experts declaring the line impracticable, as no steam wagon could run around them. Five per cent. had been paid in, and shares had been sold at an advance of *seventeen* per cent., such was the zeal and confidence of the people. But the experts' statements becoming known, operations were suspended, the chill was immense. Mr. Cooper, then thirty-eight years of age, saw new disaster to himself in the depreciation of his tract of land, should the road fail. He proposed to the directors to construct a locomotive that should be available on their line. They were willing, but incredulous. He determined to make the attempt, and brought down from his glue factory in New York city a single cylinder engine, 3¼ inches in diameter and 14½ inches stroke of piston, procured wheels 30 inches in diameter and other appliances from the railroad company, and in a few weeks ran out upon the railroad track the first American locomotive

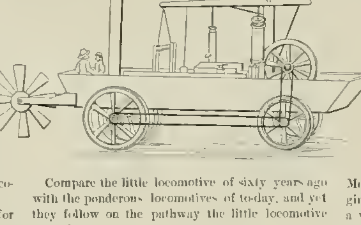
Mr. Cooper, unable to find such tubes as he needed for his boiler, used gun barrels.

This locomotive had a vertical boiler, and the draft was urged by mechanical means—a revolving fan. The wheels were connected to the crank-shaft by gearing. The whole machine weighed less than a ton.

The trial trip was to take place on a day set, but the night before, a thief stole all the copper steam and other connections and brass cocks from the infant machine, and caused some further delay.

The trial trip was run, Mr. Cooper himself acting as engineer; and when his wheezing little baby locomotive threatened to lose too much steam, he held down the safety valve with his own hands. The run was made with one carriage, carrying thirty-six passengers, making *thirteen miles* in less than one hour, and moving, at some points on the road, at the rate of *eighteen miles an hour*. That night all Baltimore was happy.

This locomotive was considered a working model only, and was rated at one horse-power The engine, on the trial, worked up to 1 43 horse-power, and drew a gross weight of 4½ tons.

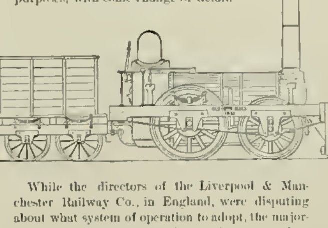


Compare the little locomotive of sixty years ago with the ponderous locomotives of to-day, and yet they follow on the pathway the little locomotive opened.

Ross Winans, writing of this trial of Cooper's locomotive, makes a comparison with the work done by Stevenson's "Rocket," and claims a decided superiority for the former He concludes that the trial established fully the practicability of using locomotives on the Baltimore & Ohio Railroad at high speeds, and on all its curves and heavy grades, without inconvenience or danger.

Mr. Cooper made the above experiment at the *same time* that Robert Stevenson's "Rocket" was run on the Manchester & Liverpool Bailway, England.

The fact is, that applying the steam engine to locomotion was regarded as a much smaller feat in America than it was in England. The representative engine in England, at the time railways were first started, was the heavy, slow-moving, condensing engine of Watt. Radical changes were necessary to convert that engine into a locomotive. America, on the other hand, had the high-pressure, high-speed engine, invented by Oliver Evans, and it was well adapted for land transportation purposes, with some change of detail.



While the directors of the Liverpool & Manchester Railway Co., in England, were disputing about what system of operation to adopt, the majority favoring stationary engines and rope traction, the directors of the Baltimore & Ohio and South Carolina railroads, unanimously decided to operate their railroads with locomotives, and gave their general managers directions to have locomotives built. The second railroad in the United States to use locomotives was the South Carolina Railroad, being built expressly for steam locomotive power.

The first regular American locomotive, the "Best Friend," was constructed in the year 1830, in the city of New York, at the West Point Foundry, then at the foot of Beach street, North River. It was designed by Adam Hall, and was sent to Charlestown, South Carolina, and placed on the South Carolina railroad. It was in successful operation for some months, when the boiler exploded.

The second locomotive, the "West Point," was built in 1830, or early in 1831, by the same works and for the same railroad company. Early in 1831 another locomotive, the "De Witt Clinton," was constructed at the same establishment, and in July of same year it was placed on the then Mohawk & Hudson Railroad, now a part of the New York Central line. The cylinders were 5½ inches diameter, the stroke of piston being 16 inches. The four wheels were each 4½ feet in diameter. The connecting rods worked upon double cranks in the front axle. The boiler had about thirty flues of copper, 5 feet long, 4 inches in external diameter, and one-quarter inch thick. The weight of this engine was about four tons.

On the 4th January, 1831, the Baltimore and Ohio Railroad Co. offered $4,000 premium for the best American locomotive of 3½ tons weight, which should draw 15 tons at fifteen miles an hour on a level. The boiler was to use as fuel, anthracite coal; it was to have four wheels, coupled together, four feet between centers, in order to pass around curves of 400 feet radius. The steam pressure was not to exceed 100 pounds to the square inch, above the atmosphere. The locomotives were to be delivered for trial upon the road, on or before the first of June, 1831, and the sum of $3,500 was to be paid for the locomotive which should be adjudged to be best.

Three or four locomotives were entered for competition; the prize was awarded to Messrs. Davis & Gartner of York, Pa., whose engine was named the "York." The locomotive had a vertical flue boiler and vertical cylinders, with four coupled wheels, thirty inches in diameter. It was altered considerably after being placed on the road.

This firm afterwards built another locomotive, named the "Atlantic," that was the first of what were afterwards known as the "Grasshoppers," which were used for many years on the Baltimore & Ohio Railroad. Some of these locomotives were in use on that road quite recently (1883), and some of them were in continuous service for fifty years.

The "Grasshoppers" were succeeded by what is known as the "Coal-crab" locomotive. In these the cylinders were placed horizontal, and they were connected to cranks in an intermediate shaft, which was geared to a second shaft, which also had outside cranks to which the driving-wheels were coupled. The vertical boilers were retained.

As an example of the performance of the above locomotive, on the 16th day of August 1832, one of the small locomotives ran an excursion train out of Baltimore, consisting of six passenger cars containing ninety passengers, the train ran forty-one miles out and the same distance back—part of the way (for four miles) up-grades, varying between 32 and 57 feet per mile, the speed on these grades being thirteen miles an hour, and for the whole trip each way, including stops, a fraction over thirteen miles an hour.

In 1832, William T. James completed at his establishment, Eldridge street, New York city, a locomotive containing the *first* link motion used in America (now universally used all over the world, and in fact wherever locomotives are in service). This locomotive was run forward and backward across the yard of the machine works, a distance of fifty feet, eight times in sixty-three seconds, including stops. (None but the most efficient reversing gear, such as the link motion is, would have secured such a result.) Each cylinder had two eccentrics, one for the forward and one for the backward motion. The ends of the two eccentric rods in connection with each valve were jointed at a distance of nine inches apart, to a curved link, which could be raised or lowered as required, upon a block jointed upon the end of the valve spindle. The link was designed solely as a means of reversing the engine with certainty when in motion. Mr. James found in setting the eccentrics (the valves having one-half inch lap on each end) that it would cut off the steam; he then used the link to vary the expansion of the steam at different points of the stroke, thus making quite a saving in fuel. The boiler used anthracite coal, and steamed freely. It was run for some time on the Harlem Railroad, where it worked satisfactorily. In 1833, it was sent to the Baltimore & Ohio railroad, but soon after having been placed in regular service, it exploded its boiler. This locomotive also had a "spark arrester," substantially the same as was in use on all American wood-burning locomotives.

In 1832, Adam Hall, of the West Point Foundry, constructed the locomotive "Experiment," the first to which the swiveling truck was ever applied, this application having been made under the direction of Mr. John B. Jervis, the then engineer to the Mohawk & Hudson Railroad. The "Experiment" had 9½-inch cylinders, 16-inch stroke five feet driving-wheels, a truck of four smaller wheels, and being intended to burn anthracite coal, the grate bars were five feet long. The whole weight of the locomotive was seven tons.

The English locomotive on that road, built by Messrs. Robert Stephenson & Co. of Newcastle—the "Robert Fulton"—after a year's run, had the front wheels removed, and a swiveling truck substituted, similar to that of the "Experiment."

This feature of construction adapted the locomotive for service on our undulating and uneven tracks, and also enabled it to pass with facility around our short curves.

Matthias W. Baldwin, the founder of the present Baldwin Locomotive Works, was the first to introduce into the United States the general features of the improved class of English locomotives, as developed upon the Liverpool & Manchester Railway, immediately subsequent to the trial of the "Rocket." Mr. Baldwin had built, in 1831, a working model of a locomotive for Peal's Museum, in Philadelphia. On the 25th of April, 1831, the miniature locomotive was put in motion on a circular track made of pine boards covered with hoop-iron, in the rooms of the museum. Two small cars, containing seats for four persons, were attached to it, and the novel spectacle attracted crowds of admiring spectators. Both anthracite and pine-knot coal were used as fuel, and the exhaust steam was discharged into the chimney, thus utilizing it to increase the draft.

The Philadelphia & Germantown Railroad Company gave Mr. Baldwin an order for a locomotive in the spring of 1832, when it was completed, and open for travel with a double track of iron "T" rails resting in cast-iron chairs, which were securely fastened to stone blocks by means of screw bolts. Four-wheeled cars were used, propelled by horse-power. This being rather a slow process of locomotion, the above locomotive was ordered. This locomotive was completed, christened "Old Ironsides," and the trial trip was made November 23, 1832. (See cut on page 10.)

In the summer of 1833 the Ironsides was run over the road at the rate of *sixty-two miles an hour*—several persons on the locomotive having carefully timed it, among whom was Dr. Patterson, of the University of Virginia. The locomotive ran 2¼ miles, in which were four very short curves, in 3¼ minutes, or at the rate of *forty miles an hour*.

Mr. Baldwin was the first to introduce the fastening of the cylinders to the outside of the smoke-box, and what was much more, he patented and first used the metallic ground joint for cylinders and steam-chest covers and steam pipes.

The "Ironsides" was a four-wheeled locomotive, similar to the English practice of that day, as shown in the "Planet" class, and weighed, in running order, about seven tons.

The Baldwin Locomotive Works have turned out over 9,750 locomotives since the "Old Ironsides" of 1831. That locomotive was nearly a year in building, and the one thousandth locomotive was only completed in 1861, making an average of only thirty-three annually for the first thirty years; the two thousandth locomotive was turned out in 1869, the three thousandth in 1872, the four thousandth in 1876, the five thousandth in 1880. The present capacity of the works is equal fifteen per week, or two and one-half per day.

In the recent trials of pea coal on the L roads in this city, 67 pounds of the cheap coal were burned per mile, as against 47 of broken coal.

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More Steam Pipe Letters.

TERRE HAUTE & INDIANAPOLIS.

Last from one to three years; use hard brass rings on short fronts, cast-iron on extensions. Front end must be kept air-tight, or joints may not last a month. Time depends on conditions and men; bad joints, two hours. We scrape to a bearing, grind very little. Cost, from $1 to $1.50.

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Time they run all depends on how they are handled. Takes about eight hours to grind; cost, $4.25, sometimes a little more.

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UNION PACIFIC.

When we want to get out flues, about once in two years. Time depends on condition of pipes; ordinarily four hours. Ordinary cost, $2.50 to grind in four bad joints.

J. E. O'HEARNE,
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On an average, once a year, regular man does work in from four to ten hours.

C. S. SMITH,
Pocatello, Idaho. R. H. Foreman.

OHIO & MISSISSIPPI.

Only when flues are removed, use an apprentice or handy helper. Time, about a day and a half; probable cost, $4.

J. W. STOKES,
Pana, Ill. Gen'l Foreman.

FLORIDA SOUTHERN.

Once in three to five years; time depends on how long joints have been leaking; one to ten days; cost, depending on time.

JOHN G. ECKMAN,
Bartow, Fla. Machinist in Charge

B. M. & M.

About once in 18 months; time, about 12 hours; cost, about $4.

A. G. RAMSEY,
Barnesville, Minn. R. H. Foreman.

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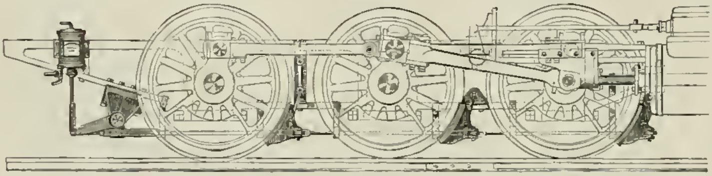

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Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers, furnished to operate with either STEAM or AIR.

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For Removing and Replacing Locomotive Drivers and Trucks

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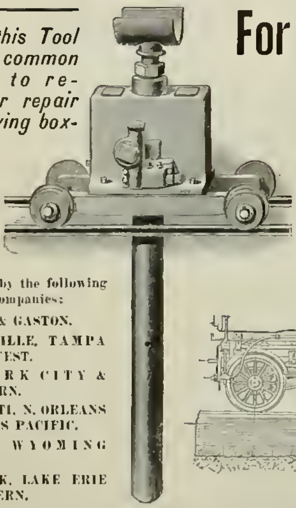

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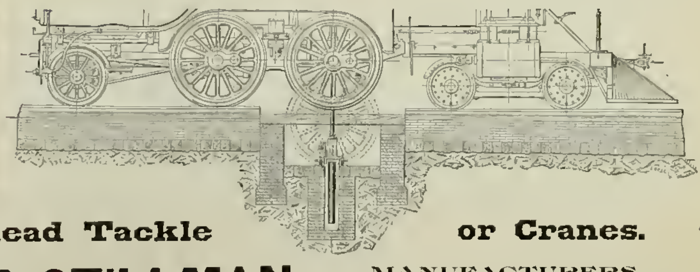
WITHOUT JACKING ENGINE UP.

NO FLOOR SPACE REQUIRED for THE TOOL.

☞ The Jack is mounted on a truck running in its own pit, at right angles to and beneath the other pits. Driving wheels may be taken out and transferred to any track in the Roundhouse or Shop. *Nothing is in its way, and it is in the way of nothing.*



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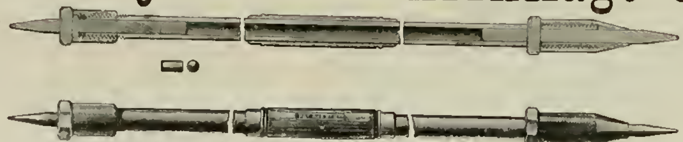

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By the use of this Gauge, the boring of Locomotive Tires can be accurately done, and with proper shrinkage to any desired allowance. It is so arranged that wear on the points is entirely overcome, there is no wear on the measuring pieces, they being hardened and ground to micrometer measurements. It is made to conform to the Master Mechanics' Standerd of Sizes and Shrinkages as adopted by them in June, 1886.

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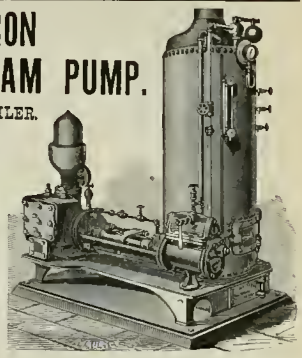

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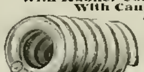

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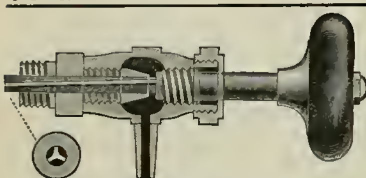

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VOL. II, NO. III. NEW YORK, MARCH, 1889. $1.00 per Year. or 10c. a copy.

The Power Brakes on Brooklyn Bridge Trains.

The cable cars on the great Brooklyn Bridge are equipped with vacuum brakes, the vacuum being maintained under each car by a pump, operated by an eccentric on truck axle. There are four men on three-car trains, and each man handles the brake on his car independent of what the others may do. Between the hours of 1 and 5 A. M., when the service is lightest, the trains are hauled by locomotives and the cable is at rest; then the hose between the cars are coupled up, and the brakes are under the control of the engineer, as well as every car conductor.

The locomotives are 4-wheel connected switch engines, with turtle shell tanks, and are used at each end of the bridge to shift the trains from the incoming to the outgoing tracks—a job that keeps them busy when trains are running from a minute to a minute and a half apart. The men only work eight hours, so that the engines are not only double, but treble crewed.

A throttle gland is not an easy thing to get or keep clean, it gets awful hot, and the studs prevent the back being easily reached, yet it is always in sight. A ring of Russia iron or brass, that will just reach from the boiler to the face of gland, and tight enough to stay on, is easy to clean, looks well, and prevents dirt from collecting where it is not wanted. The joint should, of course, come under and out of sight.

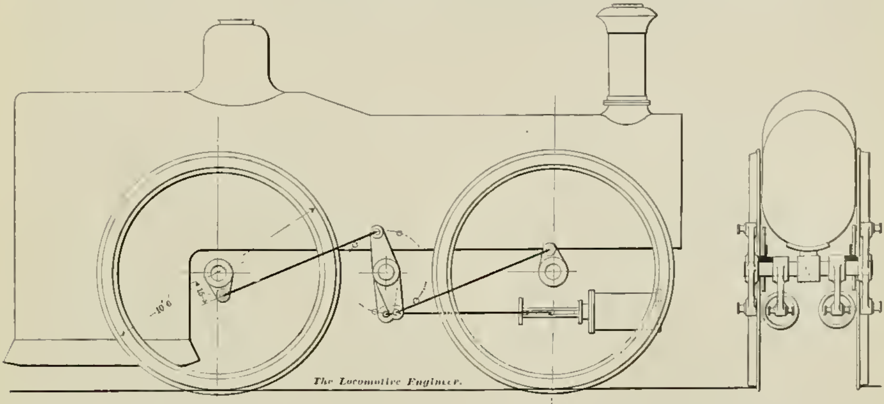
On receipt of the news of the "Q" strike settlement the *Railroad Patriot*, of St. Joe, Mo., dropped dead.

Historical Locomotives.

SIXTH SKETCH

By John J. Bingley.

In looking over your valuable paper, I notice some chapters on historic locomotives. It brings to my mind the time when I was an apprentice at the Railway Foundry in Leeds, England, about the year 1848, and one was built at that works. All engines at that time were built with inside cylinders and crank axles on the main drivers. These axles often broke, causing loss and delay. There was also at that early day a demand for faster trains. To try to remedy the one, and accomplish the other, Mr. James Fenton, the chief engineer of the works, designed a rather strange machine, of which I send you a sketch. We were building some passenger engines with one pair of drivers, and single pair of small wheels back and front, called the "Jenny Linds," as the Swedish Nightingale had just entered on her musical career. So Mr. Fenton called his new design the "Laublash," after a celebrated bass singer of Germany. As well as I can remember, there were two inside cylinders 20 by 30", the crossheads worked in guides, but the connecting rods were connected to two very strong rock arms which were attached to the frame by heavy boxes; on the out ends of these rock arms were double cranks which were about the center of the two pair of driving wheels, which were ten feet six inches in diameter; these wheels were all wrought-iron—hub, spokes and tires. The outside rods, as you will see, were connected from these double cranks to the crank-pins on the wheels, the lower crank to the forward and the top one to the back wheel, at each stroke of the pistons the rock shaft vibrated just enough to cause the cranks to revolve; on account of the height of the wheels, the boiler was built oblong, to bring the top above the wheels. The eccentrics were on the back axles. The engine was built very strong, and very highly finished, and Mr. F. was very sanguine of success in gaining speed, and doing away with the crank axle. It was finally finished and run out for trial and worked very well; some very heavy trains (so considered in those days) were hauled, and a speed of 84 miles per hour was said to be made on one trip. After running two or three weeks on trial, it was brought back to the shop and put in apple pie order for the Government Inspector to pass judgment on it before it would be allowed to go into regular service. He carefully examined it all over and pronounced the work first-class. But the design was not good, the engine having only two axles, he said if one should break, the engine would go over, therefore he condemned it as not safe; this was tried to be remedied by putting a pair of small wheels between the drivers, but this did not make it any better, and I saw her pulled to pieces, cut up, and worked up under the steam hammers. I only know of one man now in this country, E. L. Jones, of Wricksville, Ohio, who worked on that engine; he made the driving wheels and forged the cranks.



The Locomotive Engineer.

The combustion chamber, like the feed-water heater and the traction increaser, has its seasons of prosperity and adversity. It bobs up in the morning like the perpetual motion, but by noon it has been tried and found wanting. Like lots of other things about a locomotive, "it ought to—but it don't."

On the Use of Tin for Journal Bearings.

Block tin is fast gaining headway as a journal bearing. Within the past few years we find it on crosshead gibs and in rod brasses about as much as other metals, and always with better results; as a lining for truck brasses it has no equal.

In the discussion on hard or soft journal brasses under cars, recently held before the Western Railway Club, the statement was made that hard journal bearings ran with less friction than soft, but did not run cool so long, and cost more in the start.

Mr E. P. Monroe, manager of the U. S Metallic Packing Co., has made some interesting experiments during the last few years that have an important bearing on this subject

He experimented with metal of every description, with a view to finding the best friction metal, and attained the same results with all excepting tin.

First he made a pair of face plates so perfectly fitted that the air would lift lower one when its face was in contact with its mate. These plates he was careful to finish and use without a drop of oil. Placing one plate on the other, he pressed it down by hand, and drew it across the other, and then examined the faces with a glass; they showed the lines of contact, and had a fine, dark powder on them, that resembled fine emery; was sharp, but could be crushed, continued the rubbing process, and found that the fine powder gradually worked itself into globules that imbedded themselves in the softer metal. These globules were so hard they could be driven into the face of an anvil, and appeared to be carbon points, such as used for diamond drills Mr. Monroe found that constant friction between any of the hard metals produced these carbon points, some large, some very small, and found, on examination with microscope, that they were imbedded in the metal about three-quarters of their diameters, and composed the *roughness* we find in a cut journal that has been hot.

In turning up old shafts, car axles, pins and wheel tire, the workman will find these hard spots, and must take a deep enough cut to go under them, or cut them out with a chisel—as is often done in tire turning.

In these experiments, tin or babbitt metal (which is 88 per cent. tin) could be crushed by excessive loads, and melted by friction without forming any of these points, either on the journal or the box.

Engine trucks that give trouble from heating with the best of bronze or brass journal bearings are greatly benefited by lining the brass with tin.

Crossheads run well with a bearing of block tin, and will not cut the guides, and for cone rings in metallic packing it is the only metal that will not cut or score the rod.

If you have a particularly annoying pet in the shape of a box that keeps hot—unless it is the fire-box—try tin, it can do no harm, if it does no good.

Master Mechanic E M. Roberts, of the Ashland Coal and Iron Co.'s road, is building a heavy mogul engine at his shops, Ashland, Ky. He recently turned out an 18x24 passenger locomotive weighing 90,000 pounds. Mr. Roberts is the inventor of the Big Sandy sand drier—a good one.

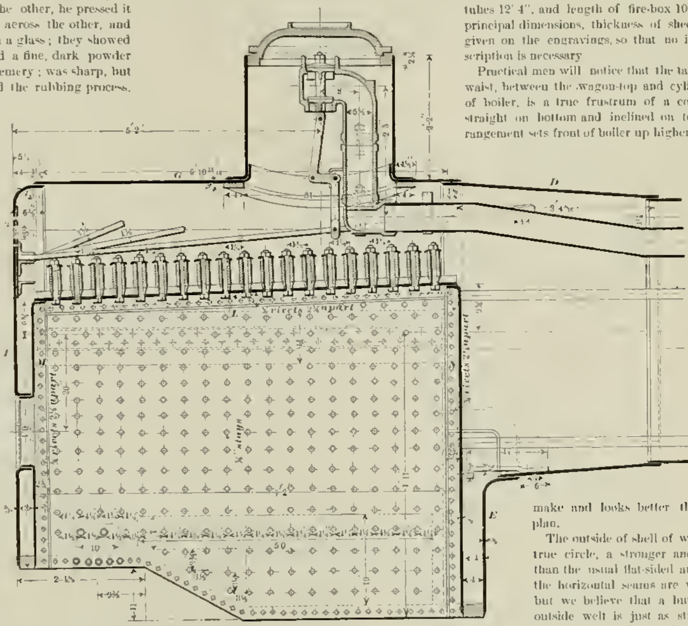
The *Union Pacific Employes' Magazine* comes out with a new cover; the engraving is a work of art.

A Curious Coincidence.

A couple of months ago we wrote up a little account of a visit to the Dickson Locomotive Works, Scranton, Pa., and mentioned that some of the neatest and cleanest engines in the country were the "Watch-charms," built by this company and employed on the Brooklyn Bridge. "Watch-charm" is railroad for a very small, neat locomotive

One of our readers in the far West took the statement literally, and ordered a watch-charm from the works, and just here comes the odd part of the story: Several years ago these works did make watch-charms in the shape of a locomotive, gotten up very nicely, costing some $18 or $20 each. Most of the "charms" they build now weigh upwards of 100,000 pounds. Our Western reader ought to get one of those charms, the works ought to see that this is no advertising medium; and all ought to study railroad Sanskrit.

The *Station Agents' Journal* has suspended.



Compound Locomotives.

The Webb Compound Locomotive is here, and the Pennsylvania folks are making some experiments with her for their own benefit. When she gets into her regular contract—to do as well as the class *K*.'s on less coal—she will be open to calls and criticisms from American enginemen, but we imagine she will have her hands full with her contract. However, in the end, compounding or some other scheme that will let us expand our pressure down much lower, has got to come. The lesson for American enginemen to learn in this matter, is to watch carefully all these experiments, see where they fail, how they lose and where they gain, and be ready to make the best of every device placed in their hands. If all the engineers on earth should condemn compounding, without giving it a fair show, so much the worse for the engineers if compounding has merits and advantages not yet brought out. We hope to present a report on the work of the Webb in an early issue

The new order, the Brotherhood of Railroad Conductors, seems to be gaining ground in the West.

Copyright Ignored.

The Journal of Railway Appliances is getting out an interesting paper. Some of the articles in the January number, four or five, we considered of enough interest to travel several hundred miles to get the data and write up for this paper, and the above-mentioned journal stole the interesting points outright, as well as some of the points made by our correspondents. We wish the editor of the *Directory of Railway Appliances* would hunt up some *appliance* that would enable him to attach the name of this paper in italics to the end of articles lifted bodily from our columns. We are grieved to think that any newspaper man could be dishonest—we thought they were all little he-angels with a bell on.

Georgia Pacific Boilers

On this and page 3 we show some details of boiler construction. These boilers were built by the Richmond Locomotive Works, for the Georgia Pacific R'y.

The smallest ring is 54" diameter, the length of tubes 12' 4", and length of fire-box 100". All the principal dimensions, thickness of sheets, etc, are given on the engravings, so that no itemized description is necessary

Practical men will notice that the taper ring, or waist, between the wagon-top and cylindrical part of boiler, is a true frustrum of a cone, and not straight on bottom and inclined on top; this arrangement sets front of boiler up higher, is easier to make and looks better than the old plan.

The outside of shell of wagon top is a true circle, a stronger and safer form than the usual flat-sided arrangements, the horizontal seams are well secured, but we believe that a butt joint with outside welt is just as strong, neater, cheaper, and easier repaired; the placing of these seams so low down and in the way of side sheet stays, is not usual practice, they are generally placed about on the line of crown sheet, where there are no stays to side of shell, the very latest practice being the rolling of entire shell sheet of fire-box end in a single piece, thus doing away with horizontal seams.

The method of placing ends of crown bars on extended edge of side sheet has its friends and its enemies, and, like cast guides, works well on one road and badly on another. In bad water we should prefer the arched bar, with ends resting on joint of crown and side sheets.

The thimbles under the bars are tapered toward the crown sheet, and the bolts have hexagon heads in fire box, instead of oval rivet heads. The boilers appear to be well made, and are as neat in proportions as we have ever seen on 10-wheeled engines.

The American Railway Master Mechanics' Association will hold its 22d Annual Convention at Niagara Falls on June 18th next. If any of the M. M's are afflicted with high-water engineers, they should bring 'em along and show them that there is no hope of their getting to the top in the high water art. Niagara has the bulge.

Massacred in Cold Blood.

Every week the *Railway Age* collects and publishes, under the head of "Casualties" a list of accidents to train men, and the specimen below is only an average sample of these weekly lists. It will be seen that the great majority of these accidents are caused by the delay or refusal of the railroad companies to apply automatic couplers. If as many passengers as this were killed and maimed every week by some big accident, where the fault could be plainly traced to poor equipment, the friends of the victims and the public in general would make it hot for the roads in more ways than one. Look at this list of mangled corpses and crippled human beings, think of the families that depended on them for bread, think that these men are mostly young, vigorous, valuable men, and think if you have a part or a voice in staying the hand of this awful plague. The *Railway Age* does not, nor cannot, hear of or publish more than half of the victims of the twin juggernauts—crush couplers and fiddlestring brakes. Railroad men far and near ought to petition Congress for a law compelling every railroad in the land to apply, and at once, automatic couplers and power brakes to every locomotive and car in the country. It is a standing disgrace upon our civilization that this people tolerate such a list of weekly murders—for murder it is, pure and simple:

H Bolton, a switchman, was caught by an engine and injured while making a coupling at San Francisco, Cal., Nov. 10.—Benjamin McNally, switchman Southern Pacific, had his foot crushed so seriously that it had to be amputated while coupling cars at Sacramento, Cal., recently.—Joseph Parker, brakeman Pittsburgh, Cincinnati & St. Louis, had his right hand crushed while coupling cars at Columbus, O., Nov. 13.—H L. Gibson, brakeman Louisville & Nashville, fell under the wheels while coupling cars at Maplewood, Tenn., Nov. 13, and had an arm taken off.—Michael O'Brien, switchman New York, Lake Erie & Western, caught his foot in a frog while coupling cars at Hornellsville, N. Y., Nov. 10, and was run over and killed.—Charles Brown, brakeman Fort Worth & Denver City, fell between the cars while switching at Quanah, Tex., Nov. 13, and was run over and his left leg taken off.—A J. Moody, switchman Union Pacific, was run over and had his right leg crushed while coupling cars at Schuyler, Neb., Nov. 15.—William Carter, brakeman Chicago & Alton, was run over and killed by a freight train near Mexico, Mo., Nov. 12. He was setting a brake when the rod broke, letting him fall to the track.—John McCarty, engineer Chicago & Northwestern, jumped from his engine at Escanaba, Mich., Nov. 18, to escape a collision, and fell under the wheels and had both legs cut off.—James Hayes, switchman Chicago & Northwestern, fell from a moving engine in the yards at Chicago, Nov. 18, and was run over and had both legs severed.—Chas. Edwards, switchman Denver & Rio Grande, was run over and had a leg taken off while coupling cars at Trinidad, Colo., Nov. 15.—Michael J. McCarthy, brakeman New York, New Haven & Hartford, fell from a moving train at Hartford, Conn., Nov. 8, and was run over and instantly killed.—George Thain, brakeman Southern Pacific, fell from a moving locomotive at San Francisco, Cal., Nov. 11, and was run over and killed.—A conductor named Webb, on the Gulf Colorado & Santa Fe, had his hand crushed while coupling cars at Weatherford, Tex., Nov. 14.—H Wilson, baggageman Gulf Colorado & Santa Fe, had his hand crushed while making a coupling at Woodstock, Tex., Nov. 13.—Joseph Gorman, fireman New York, Lake Erie & Western, fell from his engine near Hancock, N. Y., Nov. 17, and was instantly killed.—Samuel Gregg, fireman Gulf Colorado & Santa Fe, was seriously injured near Berwyn, I. T., Nov. 19. He was shoveling coal into the furnace, when one of the flues blew out, the steam striking him with such force as to throw him from the engine. Besides being severely burned by the escaping steam, he had his foot crushed and received serious internal injures.—George Sprettle, a switchman, was run over and had a foot taken off by a passenger train at St. Paul, Minn., Nov. 19.—Louis Brooks, freight conductor Pennsylvania Railroad, fell from a moving train near Kinzer's, Pa., Nov. 19, and was run over and instantly killed.—James T. Alvey, track-walker Louisville & Nashville, was run over and killed by a freight train near New Haven, Ky., Nov. 18.

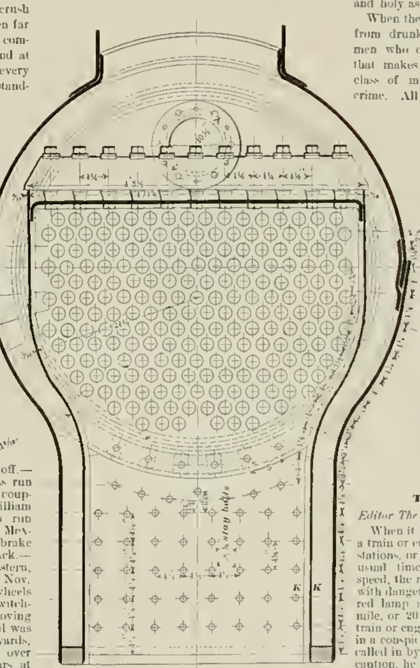
Car builders report a falling off of orders.

R. & A. Shops.

The Richmond & Alleghany shops at Richmond, Va., are the cleanest railroad shops in the city. They are situated near the Tredegar Iron Works, at the foot of Gambel's hill, and, like the road, are not over six or eight years old; the roundhouse is of brick, with an iron girder roof, and a half-finished door arch supported on a temporary wooden brace which plainly says: "To be continued." The tools in the shop are all modern, and arranged with ample room between them.

The motive power is principally Grant engines, and they are kept up in very good order, and above the average for cleanliness.

Master Mechanic Hassman came up from the ranks, having been foreman in these shops a few years ago; he is a progressive mechanic, and shows it in his work; he is the inventor of the benzine tire-heater, a very simple device, that can be made in any shop, and, while not so quick or good a heater as other and more elaborate ones, is also less expensive. General Foreman Henry Evans is a graduate of the Paterson locomotive shops, and the man who insists on a broom for the floor and hot water for the windows.



Steam-heated cars are common now, and seem to have come to stay. As far as uniform heat is concerned they are little if any better than stoves, with the same amount of attention, but are undoubtedly safer in case of wrecks. Some anti-fire heater that is independent on each car would be the proper thing, but that problem is as yet unsolved. With a continuous heater, and careful and intelligent attention in each car—governed by a thermometer in the center, and not by the whims of passengers—good results and comparative safety are secured.

The rocking grates used on the Richmond & Danville road are merely flat bars across the fire box, arranged to rock; these bars are perforated with ¾" holes, giving not over 25 per cent opening, yet they burn soft coal on them very successfully.

Correspondence

Send a Thief to Catch a Thief.

Editor The Locomotive Engineer:

If you read the daily papers very closely, you will notice that, in a bill introduced in the Wisconsin State Legislature, railroad conductors shall examine and report if an engineer takes a drink, on or off duty.

Should the conductor be in the habit of filling up, how could he smell it on the engineer? Have they always been sober, or the engineers always drunk, so as to necessitate the watchful care of the all-seeing eye of the conductor?

This law (?) looks to a man up a tree as if the framer had been convinced that all the engineers were a drunken lot, and all the conductors as pure and holy as a martyr's tombstone.

When the officials of a road cannot tell sober men from drunken ones, they should be replaced by men who can tell. The introduction of any law that makes spies, spotters and informers of one class of men, opens up a chance for abuse and crime. All the honorable men now employed as conductors would refuse to obey such a law, and all the scoundrels would lave in its (to them) refreshing waters.

The Solons of our State are also figuring on a color blind law for engineers—no good engineer wants to run with drunken men, or with men who are not able to distinguish signals—but we should all stand firm for a law asking us to simply distinguish the different colors of flags employed on the road, with no optical delusion rackets whatever. In a recent case in Minnesota, the company doctor declared an engineer color blind, and he was discharged; he at once submitted himself for examination by several prominent physicians, who all declared that he was not afflicted by any color blind trouble whatever. The color blind racket is a very good excuse to pull a man off for personal spite. C. S. C.

Watertown, Wis.

The "Torpedo Nuisance."

Editor The Locomotive Engineer:

When it becomes necessary, from any cause, for a train or engine to stop on the main track between stations, or to stand at a station longer than the usual time, or to proceed only at a slow rate of speed, the rear brakeman must go back instantly, with danger signals (red flag and torpedoes by day, red lamp and torpedoes by night) at least half a mile, or 20 telegraph poles, to stop any following train or engine; he must display the danger signal in a conspicuous manner, and remain there until called in by the conductor. As an additional precaution, he must immediately fasten a torpedo to each rail, which must not be removed, and when called in he must fasten another torpedo to the rail, 10 telegraph poles from the rear of the train.

If the train is stopped on a curve, or if the weather is so foggy or stormy that the danger signals on the rear end cannot be seen for a distance of half a mile, the flagman must not be called in, but must remain to flag, stop, and get on board the following train. In all cases, when called in, torpedoes must be fastened and left to the rails before returning to the train.

Should any detention occur on single track, or the opposite track be obstructed, the baggage master of a first-class train, or the head brakeman of a second-class train, must instantly go forward a like distance using the same precautions to stop approaching trains or engines.

The engineer is authorized, and it is his duty when his train stops, to order the flagman back with danger signals by giving three blasts of the whistle. See rule 11.

Conductors and trainmen have no right whatever, at any time, to presume that other trains are not closely following or approaching.

This rule is imperative, and conductors and engineers will be held responsible for its strict enforcement, and they may command the services of any employe of this company to fully and promptly carry it out.

Engineers when running over torpedoes must come to a full stop, and then proceed slowly with their train under full control, until the cause of danger is known, or the obstruction is reached and passed.

The above rules are clipped from the time table of one of our Eastern trunk lines, and at first sight would appear as if they were calculated to enhance the safety of trains moving in strict conformity with them; but a literal compliance with them would be sure to produce delay in the movement of the trains, and by this delay indefinitely increase the danger to life, limb and property. For instance, a local freight leaves a division terminal two hours ahead of a through freight, but before the trains reach the other end of the division, there is only one hour between their schedule times. Now, it sometimes happens that the local has a rush of freight to handle and becomes late, and in some instances trespassing on the time of the through freight. The flagman of the local freight strews the road with torpedoes, for, according to the rules, he must leave three torpedoes every time they stop, no matter if they are on time or behind their time, and infringing on the time of other trains. Of course, the local train will not be endangered if the rules are obeyed, for the following train will have ample notice of its whereabouts but let us see how about the through freight and its extras or following sections.

As many as *thirty torpedoes* have actually been found on the above line by the through freight, in a distance of that many miles, and that without getting sight of the local. Now, according to the last clause of these rules, engineers must bring their trains to a *full stop* whenever they run over torpedoes. In literal compliance with the rules it would require at least fifteen minutes to come to a stop, have flagman place torpedoes, call him in, and start our heavy freight or coal trains into a fair speed. If this starting and stopping process were to be repeated for the thirty torpedoes, we would have fifteen stops of fifteen minutes each, or 3¾ hours of lost time in a distance of 30 miles, or more than enough to get over the whole division.

The through freight coming upon the torpedoes placed by the local, and making the frequent stops required by them, would be sure to be behind its schedule time, and its extras or following sections would be sure to catch up and follow close, and thus make it a matter of chance whether the flagman of the through train would have time enough to get out a proper distance to prevent disaster, at the so often recurring stops.

Of what use is a torpedo, and what does it say? are the questions raised under these circumstances. The reply to the first question is supposed to be, to indicate danger ahead; but is this true? To answer this let me try to hear what a torpedo says.

No one will attempt to say that a torpedo conveys any further information than the fact that some one, presumably the flagman of preceding train has placed it on the rails, but when it has spoken once, and told you that, it ceases to give you information; if telling you what your time table has already told may be called information, for that (if you consult it) will have informed you that other trains are ahead of you on the road. In regard to the distance which the preceding train is ahead, or the time which has elapsed since the torpedo was placed on the rail, you cannot get an answer, and as these—the most important points—are left in doubt, what good does it do to tell the other fact, which all hands were fully aware of? Torpedoes used in this manner tell nothing, but might be able to convey valuable information if properly used, and their language properly understood. For instance, have it understood that wild cat trains use the left rail, and fasten two torpedoes on that, nearly touching each other. In regard to a regular train, having its schedule time laid down, it should prohibit the use of torpedoes if it is on time, but if behind its time, the use of one torpedo might be understood to mean behind time up to fifteen minutes, two torpedoes between fifteen and thirty, three torpedoes between thirty and forty-five, and four between forty-five and an hour. Torpedoes used like this would afford some practical information, and enable trains to follow each other with a certain degree of security, entirely unknown to the above rules.

Beside this torpedo method, there are at present a number of devices, worked by levers or electricity, which are designed to inform trainmen whether a preceding train has passed a certain point ahead, or how long ago it passed the signal post under observation.

As some of these devices are very simple in construction, and entirely automatic in operation (and never failing or going to sleep like poor humanity sometimes does), it would seem as if a few hundred or even thousand dollars invested in equipping a road with such devices, would prove a far better investment than the ever recurring expenditure for torpedoes, which, in reality, as at present used, are more of a nuisance than anything else.

VULCAN.

Items from India.

Editor The Locomotive Engineer:

I am in receipt of all my papers for 1888, and as I have been much interested in details from America,

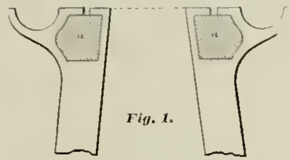


Fig. 1.

I send you a few items that may be of interest to enginemen everywhere.

In your May number you illustrate a variable ex-

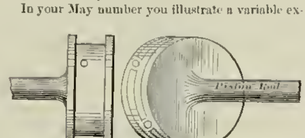


Fig. 2.

haust nozzle—something we do not have. With our engines, the blast pipe is a fixture, the cap is

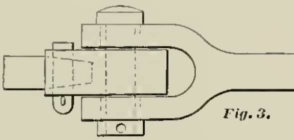


Fig. 3.

cast-brass and serves two purposes; the blast is single, and the flange shown (Fig. 1) is to support

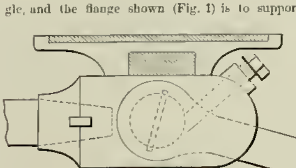


Fig. 4.

spark arrester; it has a cavity cast around it into which the blower pipe is tapped; there are a number of small holes drilled into this cavity, and they are the openings for blower. Diameter for English coal, 4¼", for country coal, 4½". The country coal used here is of several sorts, some hard, some soft, for which we have different spaced fire-bars. For English coal, air space between bars is ⅜"; best country coal, ⅝"; indifferent quality, 1¼". English coal costs here £3 ($14.35) per ton; best country, £2; indifferent, £1. Our best home coal comes from the northwest of India, and is called "Rumsigurige." I saw also a device for holding piston bolts. With us, pistons are solid on rod (Fig. 2), the rings are cast-iron, sprung into recesses of head and held from turning by studs in bottom of recesses.

Our crossheads I attempt to show in sketch (Figs. 3 and 4). On our Dubbs (Scotch) passenger engines, outside cylinder, the crossheads are of wrought-iron, solid; the little end of the main rod is forked, going around central block, and this block carries the piston in front and is jointed to the slides of the crosshead by the case-hardened pin that holds the front end of rod; the top and bottom of crosshead slides are lined with white metal.

FRED. W. BEDFORD,
Sohagpur, E. Indies. Locomotive Foreman.

Clubs are Trumps.

Editor The Locomotive Engineer:

Some sanctimonious reader may attack me for using such a phrase, but it is very expressive on this occasion, so we hope he will defer, unless we commit a worse wrong.

Yes, clubs are trumps, and we refer to the kind of clubs which hold forth every month in the East, West, North, South and center, if you please, for the purpose of progressive railroading. There you will see (or if you can't see them, you may read what they say) our wide-awake S. M. P's, M. M's, and M. C. B's, all primed up on some subject relating to the maintenance of the rolling stock and machinery under their charge. The exchange of views generally brings about a *mean* from what each man claims is the best, because it is *his* way. And they are never at a loss for subjects; for in the continual march of progress there is always a chance to discuss something.

Now, it has often occurred to me what a grand thing it would be if locomotive engineers and firemen would establish such monthly habits for the discussion of the practical every-day occurrences, as well as the design and construction of the locomotive. They need not go to any expense, for they already have meeting rooms, and if but one hour of their regular meeting was devoted to such a purpose, it would not be long before we would have to address some as M. M. But suppose no such advancement came, would it not be a satisfaction to be well acquainted with your engine and duties? Why, I actually saw a man who had been firing a locomotive fourteen months, and he did not know what or where the eccentrics were, and he was a poor guesser, too, for I asked him what he supposed they were, and he pointed to the link.

Within a radius of one mile of Troy, N. Y., there are about one hundred engineers and firemen; if but one-tenth of these would make a start, and mean business, it would not be long before they would have quite a following. You don't have to be an orator or statesman to give an account of some tussle with the air brake or steam heating apparatus, although one would cultivate the use of more choice language in such a place than we sometimes hear about the roundhouse.

Let some one make the start, and I will wager the child will grow to full manhood the first year.

Green Island, N. Y. C. F. R.

A Good Gauge Lamp.

Editor The Locomotive Engineer:

After reading the last LOCOMOTIVE ENGINEER I made a bee line for the roundhouse, drew a new gauge lamp globe, and had it painted precisely as Mr. Conger directed. The next trip it was ready, and I made it a point to get to the engine and do the scratch act before my engineer showed up. He came late and hurried into his overclothes, and oiled around, backed into the train, tried the air and pulled out.

After we were out of town he noticed the lamp and examined it very carefully, then said: "Where did you catch on, Squirt?" I told him I read the receipt in your paper, and he pulled out a dollar bill and told me to have that paper sent to him. It is the boss lamp, and all the boys ought to fix one up.

JAS. ARCHIBALD.
St. Louis, Mo.

One Reason that Locomotives are not Square at All Points of Cut-off.

Editor The Locomotive Engineer:

In looking over the back numbers of LOCOMOTIVE ENGINEER I found a "Valve Motion Sticker," from "A Reader," Wilmington, Del. It was in regard to an unequal travel of valve with lever at different points of quadrant.

I would offer my experience with the same "sticker," as I "stuck" to it until I found at least one reason for the inequality of travel.

It was simply the disregarding of offset in lower rocker-arm, when, according to correct principles of designing valve motion, this should always be taken into consideration. In the link motion, as used on locomotives, the center line of motion—a line drawn from center of shaft to center of link block pin—is not parallel to the center line of the engine—a line drawn through the driving shaft and parallel to the center line of cylinders.

My experiments were made with a full-sized Richardson model. I first took a motion curve that showed exactly equal cut-off for both ends of the cylinder for all positions of lever and then changed the model, giving improper offset with the following result:

ROCKER-ARM IN LINE.		ROCKER-ARM OFFSET.	
Head end.	Crank end.	Head end.	Crank end.
23¾"	23½"	23¾"	23⅛"
18¾"	18"	18¾"	18⅝"
12¾"	12"	12½"	12⅞"
9"	8"	8"	8⅝"
7"	6"	5½"	6¼"

Which shows more equal cut-offs when rocker is given proper offset, although I believe the difference is so slight that a great many builders, or rather a great many engines are built, with the matter of offsetting disregarded when the amount of offset is less than ⅜".

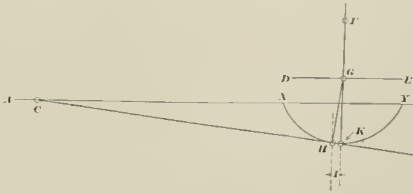
The way we obtained the correct offset was as follows: (See sketch below.)

Let C be center of main driving shaft, A B a line drawn through center of shaft and *parallel* to the center line of cylinder, D E a line drawn through center of rocker-box and *parallel* to the valve seat, F center of upper rocker-arm pin, G center of rocker-box.

The radius of arc X Y equals length of lower rocker-arm. Then a line drawn through C and tangent to—or, what is plainer, touching the arc X Y in but one point—will be center line of motion; then a line drawn perpendicular to the center line of motion *and through* the point G will touch the arc X Y in the point H, which is the position of center of lower rocker-arm pin, when upper arm is perpendicular to valve seat; then, instead of K being its position, it should be drawn toward the main shaft the horizontal distance L. I did not set out to explain how to design or lay out link motion, but only to give one reason why the valve will not travel, in some cases, equally each side of center of valve face for all positions of reverse lever.

CYRUS F. RICHMOND.

Troy, N. Y.



What Ails the Headlight?

Editor The Locomotive Engineer.

There are a great many points about a headlight that both old and young runners get onto by very little experience. Then there are some defects which are not so easily discovered and remedied, and which makes a runner ask, why the headlight on the "old 11" gives such a good light, and the brand new one on the "66" is no good at all?

I am not a practical headlight maker, but I have fixed over several headlights that would not show a switch target three car lengths off, so they would plainly light up the fifth telegraph pole from the cab—about 40 rods—and if these observations are not just what the headlight makers think they should be, we will be pleased to hear from them.

In the first place, a headlight is constructed on a scientific plan, and if it is not just right, no amount of work in cleaning and trimming will make it show a good light very far ahead. If the flame does not come just in the focus of the reflector, the rays of light will not go straight ahead, but will be diverted from their proper course and go every way but the right one. The shape of the reflector is generally right, but a great many of the burners are not soldered on just where they belong, so the light does not come in the proper place in the reflector. Some of the reflectors have a little prick punch mark exactly in the middle (measuring from the outside edges). When the flame is burning at the proper height to give a good light, the center of the flame should be exactly on a level with this mark, and if it does not come there, have the burner shifted so it will. Then, the rays of light coming from the flame and striking the reflector will be reflected straight forward where you want them instead of outside of the right of way—enough light will go out there without sending it. The diagram No. 1 shows one way, and No. 2 the right way.

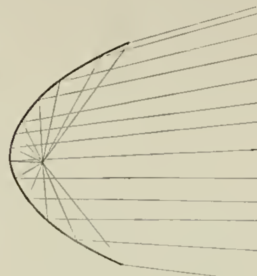


Fig. 1.

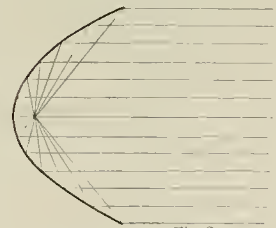


Fig. 2.

Then after the burner is set right have the headlight case painted white on the inside, except on the top and the glass. Paint the back of the reflector and the projecting rim around the glass where the light strikes it *sure*. If the headlight is very high up from the rail, as is the case on our modern express engines, it is a good plan to tip the top of the headlight case a little forward, and put a wedge on each side on the bracket. This will throw the light towards the track where you want it, instead of up in the sky.

The first time you put in a new wick, show your fireman how it is done so he will know something of the construction of a burner. Tell the first man that comes around with some patent polish which will rub all the silver off your reflector in two cleanings, that lampblack is good enough for you, and stick to it. Keep a piece of pipe in your head light case to blow it out, and then the hostlers won't turn it down to put it out. And right here I must say, that the engine that needs the best headlight and has the poorest one is the switch engine.

Lansing, Mich. CLINTON B. CONGER.

The Rogers Locomotive Works, Paterson, N. J., are working on short time. Lack of orders is the reason.

About Sizes of Nozzles.

Editor The Locomotive Engineer:

I am stuck. Last month I made an agreement with an old machinist in the shop—an ex-runner—that I was to come to him every trip, and he would give me a question about engines; I was not to come with an answer till I was sure I had the right one, and could tell the *reason why*—in fact, pass a sort of examination on the subject—for each and every question I missed or answered wrong I was to pay 25 cents.

To date I have answered nineteen questions, and am out 25 cents and *in* that many dollars' worth of information. Now he has got me up a tree, simply because I don't know how to figure. The question is

"Suppose you were running an engine on construction, away from shops, and got an order to measure the double exhaust nozzles, and order a single variable nozzle that had the same area of opening as the double nozzle, when wide open, size of central plug 2", what would be the outside diameter of the single nozzle, provided your double nozzles measured 2⅜ each? TEXAS.

Galveston, Tex.

[To find the area of a circle, square the diameter (multiply it by itself), and multiply the product by .7854. By doing this you will find the area of a 2⅜" circle is 4.4301", twice this is 8.8602", the combined area of the nozzles. Now, you want a single nozzle of the same area with a 2" plug in its center, by the above rule we find that a 2" circle has an area 3.1416", we add this to the area of nozzles, and find we have 12.0018"—practically 12". A circle containing 12" of area would be 3.9625—practically four inches.

We think your plan of study a good one, and thank you for the suggestion to others. Be sure you get a good man as reference.]

Nothing Like Printers' Ink.

"The value of advertising was demonstrated this morning, when Messrs. Becker & Lathrop received a letter from an engineer at Sohagpur, East India, ordering an engineer's clock. The engineer had read the advertisement in an engineers' paper, which had found its way to Central India, with the above result. The letter came by way of Bombay, Brindisi, London and New York, and came inside of thirty days. American wares beat the world."

Editor The Locomotive Engineer:

Above find clipping from the *Syracuse Daily Journal*, which will speak for itself.

I think Becker & Lathrop have acted wisely in resuming their advertisement in your valuable paper, for, judging from the letters and orders that Mr. Lathrop has shown me from all over the country, they will do a good business in the line of locomotive clocks.

From Central India to Central Missouri is covering lots of territory.

Syracuse, N. Y. W. F. RELYEA.

Intelligence and the Coal Bills.

Editor The Locomotive Engineer:

I noticed in your February issue that the Supt. of M. P., on N. Y., L. E. & W. R. R. had presented the firemen on that road with copies of Sinclair's work on "Combustion in Locomotive Fire-Boxes." I think this is a step in the right direction; if some of our western superintendents of M. P. would follow the example set by Mr. Kells, they would find that the company's coal bills would be smaller than now. When I commenced firing, the engineer who broke me in used to tell me to load her; after we had got over thirty miles of the road the engine would not steam, simply because I had overloaded her. One day I got hold of Forney's Catechism of the Locomotive, and read what he says on combustion. I learned that, by feeding the furnace with just as much coal as it required, and admitting the requisite amount of air above and below the fire, that it was possible to make long runs and have plenty of steam. I followed Forney's advice, and have been successful; I now make the same runs with 25 per cent. less coal. FRED. TAYLOR,

Marion, Iowa, Fireman C. M. & St. P. R'y.

A Spring Remover and a Substitute for a Broken Hanger.

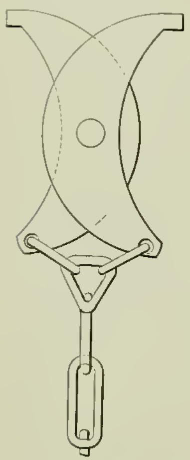
Editor The Locomotive Engineer

The spring kink described by Mr. Hitchcock, of Minneapolis, is a very fine tool, but rather expensive, and of too many pieces. The same tool can be gotten up much cheaper, and within the reach of many who do not enjoy the machine and blacksmith facilities he no doubt does. I enclose you a sketch of a tool that should be carried on all engines, especially American passenger engines. It is constructed of two pieces of 2"x¾" iron, with gib end turned up to give more strength, and prevent the three ⅝-bolts from shearing. The two pieces are bolted to a wrought or cast block, 5" long, by 4" wide and 2" thick. The pieces are bolted with three, or even two ⅝ bolts, tapped into the block. The side pieces should be 48" long, with three sets of holes at end to put a ⅞" key bolt through on top of spring. The screw is steel, 10" long, 1½ diameter. When an engine stands on a pit, it can be slipped up from pit, if on track, the three small bolts are taken out, and block and one side put in position, and then other side to be bolted in place, and bolt put across spring on top, and the jack is ready for business.

A. T. Hooker,

Gen'l Foreman E. T., V. & G. Shops.

Chattanooga, Tenn.



To Remove Cellars.

Editor The Locomotive Engineer:

I send you a sketch of a little device we use to take out driving box cellars; it may not be new to all, but I think it will to some. All roundhouse men have had trouble in removing cellars; they are hard to get at and dirty. We have found none that have failed to come down with this device.

It is made of spring steel, the points hooking into the cellar bolt holes, and the chain long enough to reach past the pedestal brace, and having a hook to catch the bar.

F. C. Robinson,

Gen'l Foreman Wabash Shops,

Danville, Ill.

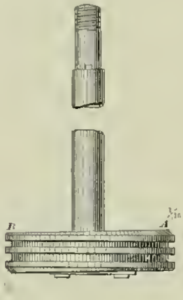
A Little Practical Air Pump Theory.

Editor The Locomotive Engineer:

How many will agree or disagree with me on the following theory? Here it is: About six months ago I gave a six-inch pump a general overhauling. In doing so it became necessary to bore the steam cylinder and make a new piston and rod. There being no casting on hand, the piston was made of wrought-iron, and was turned $\frac{1}{16}$" smaller than the bore of cylinder. After taking extra pains to put the pump in good shape, I put it on engine 565, N. Y. C. R'y, and the first trip she made the engineer complained about the pump groaning, no matter how much oil he gave it. I thought the oil cup might have something to do with it on account of not feeding steady; so I took it off and put on a new one, which fed all right, but the pump still groaned or chattered continually. Thinking that perhaps the piston might fit the cylinder a little too close, I took it out and turned off another $\frac{1}{32}$", making it $\frac{3}{32}$" smaller than the bore of cylinder, but it did not stop the chattering. After taxing my brain to its full extent I came to the conclusion that the fault must be in the oil cup, so I put on a fine working sight-feed oil cup, but, although it helped it some, it did not entirely stop the chattering. Well, I concluded to let it run for a while, thinking perhaps it might improve with old age, but no go.

I now became desperate, and vowed a vow that I would make that pump run smooth or bust it, so I took the piston out again, and rolled it along on the bed of my lathe to see if the piston ran true with the rod, and to my satisfaction found what I believe to have caused the chattering, it was this: The piston had been roughed out on a mandrel first, then put on the rod, turned to fit the cylinder and sent to me from the main shop (where the job was done), and pronounced all right. Now the mandrel on which the piston was first turned could not have been true, because, when I rolled the piston rod on the lathe bed the piston ran out about $\frac{1}{16}$", that is to say, it was not faced off, but was turned so that the annular surface of piston was parallel with piston rod, leaving it in the shape of the drawing, which you will find enclosed.

Now, my theory is (if it may be called a theory) that, when the piston was on the one stroke, the point *A* being lower than the point *B*, the steam forced the piston toward *A*, and when on the return stroke toward *B*, which caused the chattering.



Now for the remedy: I took the piston down to the shop, told the general foreman my trouble and theory, and asked him if he would have the piston faced off so that it would be true with the piston rod. Well, he laughed at my theory, and said he did not *take any stock in it, but would do the job to please me*. The piston was faced off, I put it back in the pump, and after the engine had made a trip I asked the engineer how the pump worked. He said it worked perfectly smooth with much less steam, and he did not hear a squeak or a groan out of it. And it has worked perfectly smooth ever since I had the piston faced off.

I hope some practical man will give his opinion on my theory.

W. F. Relyea.

Syracuse, N. Y.

Air Brake Practice.

By J. E. Phelan.

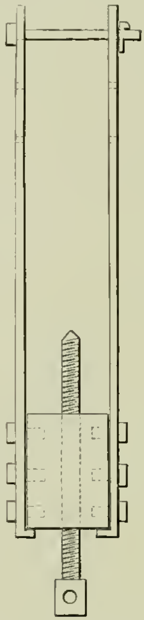
TENTH PAPER.

Knowing how to keep an air-pump in good order, and maintaining the proper pressure and volume of air, the next most important matter is to know how to properly apply the air in handling the engineer's brake valve.

With recent changes in design, probably no part of air brake appliances seems more a matter of interest than the engineer's brake valve.

On various railroad systems you will find several designs of engineer's brake valves. The original engineer's brake valve or 3-way cock (see first paper on Air Brake Practice in Locomotive Engineer, May, 1888,) and many of same design are still in use at certain points in the country (see second paper, June, 1888). The main function of the engineer's brake valve is to act as a sort of union depot or common transfer station for the compressed air. The air-pump gathers the air from the atmosphere and deposits it in the main reservoir. The engineer's brake valve then controls its future actions as manipulated by the engineer, subject to needs of the service. The function is to draw on the main supply and distribute same through train pipes and auxiliary reservoirs under the cars, and once the latter is supplied, it controls not only the main supply, but the disposition of, and action of, all that may be stored under train as well as in main reservoir.

The original engineer's brake valve or 3-way cock consists of a socket in which rests a plug, with handle attached. From the socket, openings run in three directions—one to main reservoir, one to train pipe and auxiliaries, and one to the atmosphere. The plug has a slot running through from one side to the opposite, and another slot running out from center of the through slot to third side, thus leaving one side blank.



Spring Remover.

The control of air and its passage through this medium of exchange is as simple as business done at a transfer having but one daily train each way. But when simple and light work ceased, the use for this simple device entered the shady past.

When indefinite numbers of cars began to be coupled in air brake service, this simple device would not meet the requirements. The principle on which automatic air works is that of the greater pressure controlling the lesser. If triple valves are forced down to bring brakes to action by a given pressure, it naturally requires a greater pressure to force this valve up into release position, against the original given pressure with which it was set.

Say, with the original device we have 70 lbs. in main reservoir, and an equal pressure in train pipes and auxiliaries, when brakes are set. To set brakes, we simply close communication with main reservoir and allow air to escape from train pipe; this reduces pressure under piston of triple valve, and allows pressure on top of piston and in auxiliary to force piston down, until opening into brake cylinder is uncovered, when air rushes from auxiliary into an empty cylinder. (See third paper, July, 1888, and fourth paper, August, 1888.) It naturally strikes one that this air, rushing from a full auxiliary into an empty cylinder, will reduce the compression and pressure to a certain extent, similar to opening an engine's throttle and filling empty cylinders with steam from boiler, when fire is not very hot. For when this action takes place, supply to auxiliaries is shut off. Now the point is right here: if your pump has not increased pressure in your main reservoir to a degree, while it has been cut off from communication with train pipes, to refill into train pipes the amount let into atmosphere to set brakes, what occurs? You realize that the air, as it flows from main reservoirs to partially filled train pipes will come under similar conditions to that going into empty cylinders. Again, if the triple valve pistons on first cars are forced up into released position, air quickly commences to feed into partially emptied auxiliaries, and by the time the volume of air reaches the vicinity of rear cars its energy is lessened and pressure reduced, even below that in auxiliaries, and the pistons of triple valves remain down and brakes set, for want of proper pressure to release.

To ensure a volume and pressure of air in main reservoir, that would always reach all cars with sufficient energy and pressure to release all brakes, the engineer's brake valve was improved, so that it would automatically retain 20 lbs. greater pressure—more or less—in main reservoir, than it transmitted to train pipe and auxiliaries. This improved engineer's brake valve was naturally called a 20-lb. cock instead of a 3-way cock.

This improved engineer's brake valve retains the transfer principle intact as a medium of exchange.

Instead of a simple plug and socket, the improved 20-lb. cock was made up of a valve body or chamber, in which there comes in use a top valve and spring, to hold the top valve to its seat, a main valve and spring for similar purpose, and below the main valve a feed-valve and spring. The feed-valve and its spring automatically acts to retain the 20 lbs. greater pressure in main reservoir than transmitted to train pipes and auxiliaries, when the handle of engineer's valve is set in proper position. The top valve is for the purpose of controlling the opening to the atmosphere, subject to condition of its spring and action of the engineer. The main valve controls the openings from main reservoir to train pipes practically, as the plug is 3-way cock. With handle of engineer's valve in release position, this main valve holds a free opening through two fair-sized ports for passage of air from main reservoir to train pipe. When handle of engineer's brake valve is brought around, so that the end of handle spring rests against the first stop or notch, these ports are closed, and all air passing from main reservoir to train pipes must pass through the feed-valve and through quite a small opening into train pipes.

It is often difficult for some engineers to get into the habit of carrying valve in this position while running. If there happens to be a neglected coupling or leak in pipes at any point in train that may waste air in such quantity that the small opening leading from the feed-valve may not transmit air enough to supply the leak and needs of the auxiliaries at the same time it becomes difficult to hold valve in such position and keep brakes released, but the leaks should be stopped and engineer's brake valve always held in this position while running.

The balance of the work is in principle the same as the original 3-way cock. When handle is carried around toward third stop or notch, it answers opening from train pipe that allows air to escape into atmosphere and apply brakes.

About midway between the point of setting brakes and that for supplying train through feed-valve or position while running is the place or point for blanking. When handle of engineer's valve is in this position, the main valve covers all ports, so there is no communication between main reservoir and train pipes, and none from train pipe to atmosphere. This is the position to always place engineer's valve when train has been broken in two, or when brakes have been applied from conductor's valves in coaches. In this position it holds your accumulated pressure in main reservoir, where otherwise it would flow through and escape through uncoupled hose or through conductor's valve, if left open. If engineer's valve is held in this position while trouble is being located, just as soon as stop cocks are shut or cause of setting brakes from train remedied, the brakes are finally released and bleeding not necessary. When engineer's valve is in this position, and coupled in double header with air pipes through to front end and coupled to forward engine it gives the middle engineer an independent supply of air (see sixth paper, October, 1888,) and allows air to flow directly from forward engine to control all brakes in train, including tank brake on middle engine.

When properly cared for and handled, the faults of this engineer's valve were few. Like all other appliances, it would wear out in time and need occasional repairing, especially after a season of neglect.

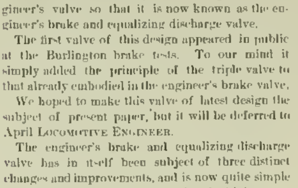
The main fault seemed to be with long trains in applying brakes. When not carefully handled, a larger volume of air than necessary would escape in applying the brakes. This air, having a sudden release from train pipe, the air from forward end would escape first, and after engineer's brake valve would be blanked, the flow of air from rear cars coming to forward cars would be stopped abruptly and the concussion would increase pressure and release brakes on forward end, and cause not only waste of air, but poor braking.

This point was made subject of improvements and caused a radical change in the design of the engineer's valve so that it is now known as the engineer's brake and equalizing discharge valve.

The first valve of this design appeared in public at the Burlington brake tests. To our mind it simply added the principle of the triple valve to that already embodied in the engineer's brake valve.

We hoped to make this valve of latest design the subject of present paper, but it will be deferred to April LOCOMOTIVE ENGINEER.

The engineer's brake and equalizing discharge valve has in itself been subject of three distinct changes and improvements, and is now quite simple and effective. We hope to relate its kinks as we have observed them.



A New Car Journal Lubricator.

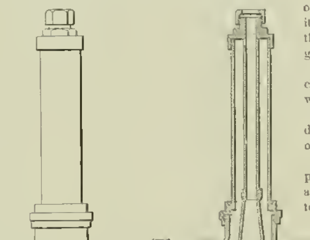
This car journal lubricator is a cup or receptacle for oil, made of vulcanized rubber from a pattern to fit the journal box, and which, from its shape and nature of material, can be placed in position—in most cases simply by squeezing it through the door of the box and underneath the journal, when it will at once resume its proper shape and position; it is then filled with oil which is conveyed to the journal by wicks or feeders of wool, cotton or other suitable material, running from the inside of the cup through openings at the top, thence down around the side and lower part of the journal through slots in the opposite edge of a rubber bar, running lengthwise at the bottom of the cup, thence back and through the same openings at the top to the oil inside; these wicks or feeders cross each other alternately, running around the journal from the top of the cup on one side to the bottom on the other, and are held in contact with the journal by the elasticity of the rubber bar at the bottom. No oil can escape from the cup except by way of the wicks, which will be constantly saturated, but absorb only what oil is necessary to replace that taken off by the journal, hence no more oil will be drawn from the cup than is absolutely necessary to properly lubricate the journal. The lubricating surface of these wicks will vary from eight to fourteen square inches, according to the size and position of the journal in the box, the number or width of the wicks can be regulated to supply the proper quantity of oil and no more. The oil being thus enclosed in the rubber cup inside, the journal-box will be kept clean and free from dust, sand, cinders or dirt of any kind. The extreme simplicity of its construction, the ease and facility with which it can be applied, renders it cheap, convenient and durable, no part of it being exposed to any movement, motion or wear except the wicks, which can easily be replaced if found worn.

The cup itself, with ordinary care, should last for several years, and should save much of the oil now wasted.

This box is the invention of Arthur W. Wright, of Detroit, Mich., who furnishes this description.

Bryant's Strainer Cleaner.

The device here shown is the invention of Master Mechanic J. T. Bryant, of the Richmond, Fredericksburg & Potomac road, and has been in use there for four or five years; it is also in use on the Petersburg road. Fig. 1 shows the outside appearance of the device. It is placed at the end of feed pipe, and between it and the tender hose, the union of the latter screwing upon it. As will be seen by Fig. 2, a plug cock controls the flow of water to the strainer located above it; this strainer can be as large as desired, from the top of the strainer a ¼ pipe is carried to an independent heater cock on the boiler head.



BRYANT'S STRAINERS

Should the strainer become stopped up on the road, the runner pulls up a rod connected to the handle of the plug cock, this shuts off the water from the tank, and opens the feed pipe and strainer to the atmosphere, through the opening shown at bottom, then, by turning steam on from the independent heater pipe, the *inside* of the strainer is cleaned by steam at boiler pressure, should the holes of strainer be full of foreign matter, the injector heater can be turned on and the holes cleaned out. All this takes but a moment, and can be done while the engine is running.

To empty the tank, the handle is turned clear over, but this cannot be done unless a man goes at it deliberately; in some of the earlier valves made, this was part of the upward motion, and men forgot and wasted the water.

In addition to its use as a strainer, it is an air chamber, and prevents the breaking of the injectors when water is low in tender.

The engineers on this road say they never take down their hose, except to show the device to some one.

It is a pity that some firm in the business is not putting this device on the market, as it is certainly a time-saving, danger-decreasing device, and a boon to enginemen, especially where open track or scoop tanks are in use.

The Union Pacific will build new general shops at Cheyenne, Wyo., and transfer the mechanical headquarters from Omaha to that place This is as it should be, Omaha is the eastern end of the system, and the end is a poor place for general shops, then the present shops are crowded into very close quarters, and cannot expand for want of room; at Cheyenne they can have all out-doors to grow in. If the new shops are built to suit the ideas of the present able and experienced head of the mechanical department—as they should be—they will no doubt rival other shops in the West, and average Western shops put average Eastern shops away in the shade.

A club of young mechanics at Boston have organized themselves for the study of steam engineering. They have adopted as a text book and reference, "Indicator Practice and Steam Engine Economy," by F. F. Hemenway. Mr. Hemenway ranks second to none in a thorough understanding of steam engines of every class, and possesses the happy faculty of writing intelligently on the subject without resort to algebraic formulæ. Students of steam engineering can do no better than to secure his writings on this subject.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS.

Oh, My Prophetic Soul—I Told You So!

The daily papers were aflame on Feb. 21 and 22 with telegraphic news that the Brotherhood of Locomotive Engineers was going to pieces—all because it was announced that a division of Reading engineers at Philadelphia had given up their charter. Interviews were published in the N. Y. *Times* of the 21st, with prominent Reading officials, who announce that the order is doomed, especially on their line, that the only reason the men remained in the order was on account of the insurance, and that now the Company's Relief Association furnished that, so that the men were beginning to "show their manhood," etc. If one regiment of an army of four hundred regiments desert, or are killed in action, it does not follow that the army is disbanding. If it is "showing manhood" to let railroad officials or any one else—friends or enemies—tell a man what orders, church, or campaign club he shall belong to, God save us from that breed of "manhood."

When the Reading gave notice that they would meet any and all employes who came to headquarters with a grievance, but would not meet any organized grievance committee of any order, we did not blame them much; but when they begin to select their engineers on account of their *not* belonging to labor organizations over which the Reading officials have no control, and *for* belonging to the Relief Association over which they do have control, instead of their ability as enginemen, then we say that the officials who assume this autocratic authority are knaves, and the men who submit to it are fools.

The Brotherhood of Locomotive Engineers is not dead enough for a wake or a funeral; its liver is out of order, and it suffers a little from water on the brain and enlargement of the gall. What the order needs in general, is a healthy revision of the by-laws, the abolition of grievance committees, more statesmanship and less representation in convention, and convention dates further apart.

The individual members need a bath in a liniment composed of equal parts golden rule, brotherly love, devotion to duty, and that kind of manhood that insists on furnishing first class work for first-class pay, and in being their own judges as to what they shall and shall not belong to.

The lodges need fewer factions and more valve motion models; less discussion about men and more about things; less jealousy of others, and more reliance in self, from a knowledge of superior information received in the lodge room discussions on engine running, firing, and general railroad work.

A man is not dead or disbanded because he has jaundice or has his leg cut off.

For a dead institution the B. L. E. is yet a breathing, kicking, and altogether lively corpse.

Electric Locomotives.

The Daft electric motor, that has been running for some months on the Ninth avenue, has been taken off, the experiments for which it was run having been completed. The current is conducted to the motor car through a copper rod outside the rails, and it is claimed that it is in no way dangerous, as a person cannot receive a fatal shock, and can only receive a severe one by forming a conductor of the body between the copper bar and the rails.

This motor has hauled three empty cars between 14th and 59th streets, for several hours a day for three months and has not held a single train.

The Daft Electric Company are now building a 20-ton motor that is expected to do the regular work of a locomotive on this line.

The elevated is peculiarly adapted to motors of this class; it is above the streets and crossings, has no obstructions, and already employs as heavy locomotives as the structure will bear. The peculiar advantage of the electric motor is in its increased tractive force—an acknowledged fact as yet rather mistily explained. Mr. Daft believes it is on account of a momentary molecular change in the metal in contact. To prove his theory he built a four-wheeled truck, the wheels being set in motion by a small motor carried on the frame; this truck was mounted upon a level track and fastened to a stationary object by a dynamometer and the wheels caused to revolve, the pull on the instrument showing exactly the tractive force exerted by the machine, then a current of electricity was passed through the wheels and rails, and the instrument at once registered some 80 per cent. more than it did before. This machine was exhibited at the patent office and patents allowed on the application of electricity for increasing traction. If they can build a motor of the same weight as the locomotive, with 80 per cent. more tractive force, it will, of course, pull a proportionately heavier train.

Mr. Daft does not expect to pull any trains on surface roads or trunk lines with present appliances; he says he can handle the service on the elevated, and will, no doubt, be given a chance to try.

He says that his company and himself made the mistake, in starting out, of claiming that their motors for street cars could be run by cheap labor; now he sees that the locomotive engineers are the men, and the only ones, fitted to run motors; the running is much the same as in a steam locomotive—a man must know the running rules and be familiar with operative railroading; a stopper and starter only is no good on any motor, be its motive power electricity, steam or soap.

In conducting the current, or power, from the steam plant to the cars, there is a loss of over 25 per cent., but it is claimed that high duty compound engines are that much cheaper on fuel than locomotives developing same power.

The substitution of electricity for steam locomotives would, we believe, require more men employed in its maintenance than at present, but whether it can compete economically in the general carrying trade remains to be demonstrated. All progressive mechanics will watch the experiments with interest.

A Beggar on Horseback.

Some time ago the management of the Santa Fe system came to the employes of the road with a statement that the road was losing money from various causes, and asked them to stand a temporary cut in wages.

The members of the various labor organizations, as well as employes outside these orders, called meetings, discussed the matter, and voted to help the company out by a uniform reduction of wages for the winter. Considering that the Santa Fe has never been noted for high wages, this was fair, and showed a fraternal feeling as far as the men were concerned, that has been heralded abroad as "a policy that kills strikes," an "insurance of higher wages in good times," etc. So far, so good. Now comes the annual statement of the road, which says:

"The profit of the Atchison system proper for the eleven months ending November 30, after providing for all fixed charges of interest on bonds, rentals, taxes and sinking fund requirements, was $1,066,000.06. The dividends declared during the period amounted to $2,625,000, leaving a deficiency as of November 30, of $1,558,999.94."

The payment of unearned dividends of over a million and a half shows that, whatever the men will stand in the shape of less wages, the stockholder proposes to have his interest on bonds—water and all.

The Santa Fe built several hundred miles of road last year that paralleled other lines, in a country that could not support both, a financial mistake that they ask the men to stand.

There are many times when fair, honest management gets into a tight place financially, and would be benefited, and perhaps saved from bankruptcy, by the help of the employes; but such disclosures as the little game on the Santa Fe will tend to prevent more deserving managements from drawing from the same source.

When men come out and say they will take less wages for a given time, to help out the company, they simply agree to live less comfortably for that length of time, that the company may not get hopelessly behind in its fixed charges, not that London and Wall street stockholders may be paid unearned profits.

John G. Eckman, foreman of the Florida Southern roundhouse at Bartow, Fla., writes us that he has had much the same experience in water splitting that others have who have written on the subject.

Statistics.

When records are kept of the number of accidents, the deaths, the injuries sustained, the axles broken, or the misplaced switches on a road, or on the roads of a State or a nation, that is called statistics—it is history. Men who are fond of carrying out all things by the addition of ciphers will pounce upon a list of historical figures—or statistics, if you like—and go on to prove, by what has happened, just what will happen next year and the year after.

Don't get in the habit of paying any attention to this breed of "statistics." If we have a small road, say employing 100 men, on which, in 1887, there were two men killed and in 1888 twelve men killed, it does not follow that, because the increase of fatality was 500 per cent. that year, that it will increase in the same ratio in '89 or '08. There are a whole lot of cranks in this country that want to prove—by figures—that the laboring men are very badly off, and need *laws* enacted to help them, this before election. Immediately after election they at once produce figures to show that workingmen are 400 per cent. better off here than any place else. They will say that forty years ago, 30,000 pounds of wheat could not have been hauled by team from Ohio to Massachusetts in less than seven months, or for less than $2,000. Now it can be hauled in three days for $50, and as a car of wheat will support life in a workingman for eighteen months or eighteen years, he is so many thousand per cent. better off than were his ancestors. They can just as well prove that food is not a necessity, but a habit, and produce figures to show how much better off men would be if they did not eat—and there would be just as much sense in it.

The workingmen of America do not want statistics compiled or *laws* passed for their benefit; they are, in most cases, a burden for them—a law cannot be passed making work plenty and pay fair.

Let us reverse the order of things, and commence to un-make laws. Repeal laws that allow a private concern to train and arm an army to shoot people for pay—and punishes the people for shooting back.

Repeal the laws that let one man, or a number of men, fence in whole townships, and make people work for them.

Repeal laws that declare a strike of employes a conspiracy, and a strike of employers a lock-out.

The Metric System.

The National Car and Locomotive Builder very properly shows up some of the disadvantages of the metric system, and the loss and confusion that would occur in a great manufacturing country like this, through its adoption. A club of New England car builders have made a proposition to the Car Builders' Association, to have that body declare in favor of the adoption of that system of measurement.

If we were a people without a standard measurement, or had many standards, as Germany had before the adoption of the metric system, and as China has now, it would be well enough to look into the merits of the meter, but it has no advantages to offer over the standard inch, and the inch can be expressed in decimals of hundredths or thousandths, with fewer figures than can the same measurements be expressed by the metric system. There is no great danger of its adoption in the workshops of America, because to adopt it would mean the expenditure of large sums of money without any returns whatever—the best of all reasons.

Relay Stations and Fast Time.

At first thought a railroad man used to soft coal would say that the changing of engines on passenger trains at Bound Brook, N. J., on the Reading and Central of N. J., on Bound Brook line, was a time-losing feature. As a matter of fact it is a time-saving feature. With hard coal a clean fire is a necessity for fast time, and the exchange of engines not only allows the man coming into the relay station to sacrifice water level, and allow his fire to become dirty or steam to go down in order to come in on time, but has an engine ready, with a clean fire, cool journals, a full boiler and a hundred and enough to bounce it to a fast train to the end of the run. Between Philadelphia and New York the two lines, the Bound Brook and the Pennsylvania, are striving to beat each other and come as close to making the 90 miles in 90 minutes as possible, and they come pretty near it.

Several years ago some of the engineers on the Pennsylvania wanted the management to make a relay station at Monmouth Junction and let every passenger engine stop there one train, giving her crew time to clean her fire, oil around, get a fresh tank of water, fill up and blow up ready for the next train. The management wanted the engines to run right through, but there is little doubt that the scheme proposed by the engineers would result in comfort to the crews and better time.

ASKED & ANSWERED

(10) Kline, Germantown, asks:

What difference is there in the heating qualities of hard and soft coal? *A.*—With a good quality of both kinds of coal there is very little difference in the heating qualities, pound for pound.

(11) C. L. Green, Blauveltville, N. Y., asks:

Will you please tell me the weight of a passenger engine and a freight engine? *A.*—Weight depends entirely upon size; average weight of modern eight-wheeled passenger engine 65,000 to 75,000 pounds. Consolidation freight engine about 90,000 pounds.

(12) D. E. S., Rawlins, Wyo., writes:

In what way does the Strong engine differ from other engines? *A.*—The novelty of the Strong engine is in the boiler and the valve gear. The boiler has two fire-boxes lying side by side; they are simply corrugated tubes 38 inches in diameter and about 8 feet long, and are enclosed in two cylinders of boiler iron; these tubes come together forming a large combustion chamber; the boiler resembles somewhat a pair of pants inflated, the legs being the fire-boxes, the waist the combustion chamber, beyond and in front of which the waist is extended to hold the small flues; the grates are set up a little below the center of the tube furnaces; water entirely surrounds the fire-boxes. The furnaces are of much less diameter than the main part of boiler. The cab is placed ahead of the furnaces. There are no stays in the boiler whatever. The forward end is carried by a double truck, and behind the drivers a pony truck supports part of the weight of the furnaces. The valve motion is derived from a single eccentric on a side, and is a type of radial gear; the exhaust and steam valves are independent of each other; they are multiple-ported; gridiron valves working vertically in plugs set in the steam passages near the end of cylinders; there is no steam chest. The entire valve motion is supported on the main driving box.

The Locomotive in America.

By Wm. Barnet Le Van.

THIRD PAPER.

In 1834, William Norris bought the interest of his partner, Col. Stephen H. Long, and commenced what afterwards became one of the largest locomotive building establishments in the world, in which one hundred and fifty locomotives have been built in one year. In conjunction with Long, Norris had patented—December 30th, 1833—the use of the separate expansion valve, working directly on the back of the main valve—a feature long afterwards preserved in the Norris locomotives. In July, 1836, Norris had completed a locomotive, the "George Washington," embodying considerable advances in proportion, arrangement and construction, upon previous plans. This locomotive weighed 14,390 pounds, and on July 10, 1836, it drew an additional load of 19,200 pounds up an incline of 2,800 feet in length, and rising at the rate of 369 feet per mile, or *one in fourteen;* the rate of speed up this incline was 15½ miles per hour, the run of 2,800 feet being accomplished in *two minutes and one second.* The combined gravity and friction of the whole weight—33,590 pounds—on the incline of one in fourteen, would be about 2,600 pounds, which amount of adhesion was nearly or quite one-third of the entire weight on the driving wheels. Such a feat in 1836, as was achieved by the "George Washington," took the engineering world by storm, and was hardly credited. The directors of the Birmingham & Gloucester Railroad, of England, became so convinced of the efficiency of the Norris locomotive, as to order several for working the Lickey Incline, where they performed successfully until further improvements had rendered them antiquated.

In 1835, Garrett & Eastwick built a locomotive with outside cylinder connections—then not much in vogue—running gear after the Baldwin type, with one pair of driving wheels behind the fire-box, and with four wheel truck in front. It had the dome or "Bury" boiler. When finished it was called the Samuel D. Ingham, after the president of the Beaver Meadow Railroad.

This locomotive had, for the first time, the rear platform covered with a roof, to protect the engineman and fireman from the weather.

In 1836, Henry R. Campbell, "in order to distribute the weight of the locomotive upon the rails more completely," patented the duplication of the driving wheels, placing one pair behind and one pair in front of the fire-box, using the swiveling truck in front of Baldwin's and others.

On February 5th, 1836, Mr. Henry R. Campbell, of Philadelphia, designed and had built a locomotive having four wheels coupled—one pair in front and one pair behind the fire-box—and a four-wheeled truck in front. This locomotive was commenced by James Brooks, of Philadelphia, on March 16, 1836, and completed May 8, 1837.

This was the first eight-wheeled locomotive of this type, and from it the standard American locomotive of to-day takes its origin. Mr. Campbell was the chief engineer of the Germantown Railroad when the "Ironsides" was placed on that line, and had since given much attention to the subject of locomotive construction.

The Campbell locomotive lacked, however, one essential feature, flexibility vertically. There were no equalizing beams between the driving wheels, and nothing but the ordinary springs over each journal of the driving axles to equalize the weight upon them (the plan still adhered to by the English to this day); as a result it was not successful. The trucks gave it flexibility laterally, but on our then rough roads it needed vertical flexibility.

In July, 1837, Messrs. Eastwick & Harrison remedied this defect when building the locomotive "Hercules," with the same arrangements of wheels as Campbell's, for the Beaver Meadow Railroad, by introducing equalizing levers between the springs, which was patented in 1838.

This firm introduced many minor improvements in the "Hercules," one of which was the introduction, for the first time into steam machinery, of the bolted stub end instead of the old-fashioned and unsafe mode of gib and key, for holding the strap on the connecting rods, now universally used in the connecting rods of all locomotive engines.

Norris at once adopted the coupled drivers with equalizing spring levers, and with the separate expansion valve, and other features already embodied in his plans, his locomotives of 1840–46 may be taken as the standard type of America—locomotives to which other builders gradually approximated.

From 1842 forward the Philadelphia builders built six and eight wheels coupled locomotives.

In 1845, the "John Bull," an English passenger locomotive, formerly called the "Robert Fulton," was rebuilt by Walter McQueen, and called the "Rochester." The first application of air vessels to both the forcing and suction sides of the locomotive pump is believed to have been made at this time, Mr. McQueen having taken portions of the four-inch copper flues of the "De Witt Clinton" to form these vessels. The arrangement thus introduced is now universal in American locomotives.

In 1846, Septimus Norris designed the ten-wheeled locomotive now in general use, and in January, 1847, the first one was placed on the Reading Railroad.

In 1849 a most important step was made in the progress of American locomotive practice—the introduction of the link motion. Although this device was first employed by William T. James, of New York, in 1832, as before stated, and eleven years later by the Stephensons in England, and was by them applied thenceforward on their locomotives, it was not until 1849 that it was generally adopted in this country.

In 1849, Edward S. Norris, of Schenectady, built for the then Utica & Schenectady Railroad, the "Lightning" Crampton, with 16-inch cylinders, 22 inches stroke, and a single pair of 7-feet wheels, which ran at the rate of 60 miles an hour in the year 1850; but it only ran a short time.

Messrs. M. W. Baldwin & Co., in August, 1849, delivered to the Vermont Central Railroad a locomotive, the "Governor Paine," with 17-inch cylinders, 20-inch stroke, and a pair of 78-inch driving wheels, and subsequently sent three Crampton engines of smaller dimensions to the Pennsylvania Central Railroad, in September, 1849.

Norris Brothers made seven locomotives for the Camden & Amboy Railroad, each with a single pair of eight-feet driving wheels and a six-wheeled truck, a cut of which was on the first page of your February issue, showing the "John Stephens."

In the year 1849, Ross Winans, of Baltimore, built a single locomotive for the Boston & Worcester Railroad. It was for an experiment in coal burning, and constructed to burn anthracite coal. This locomotive was named the "Carroll of Carrollton." It had one pair seven-foot driving wheels, and was intended for very high speeds. It had two small steam cylinders placed on the sides of the boilers, over the bearings of the driving axle, by which the weight on the drivers could be varied from three to twelve tons.

The seven-foot drivers were cast with chilled rims, and were of extremely light pattern; in fact, they became broken after running six weeks. These were replaced with a set of imported wrought-iron wheels, the first of the kind brought to this country.

The speed of this locomotive, under favorable circumstances, was one mile in sixty seconds. It was run between Albany and Boston, and the train consisted of from seven to eight cars, and made a mile a minute with ease. The engineer, J. H. Jackman, says: "Since I ran her, in 1849, I have traveled many thousand miles on locomotives, and have seen some high speeds made; still I never saw the locomotive that could lay right down to it and outrun the "Carroll of Carrollton." When I ran her we made many stops, and therefore could not make better time than locomotives having smaller driving wheels. But give me fifty or sixty miles on a clear run, and I could outrun a thunder-storm if it was going our way. In those days we had no air brakes, and to run at such high rates of speed sometimes became dangerous. I remember one instance, in the night time, of rounding a curve at about sixty miles per hour, when a danger signal met my view. I shut off steam and whistled down brakes, but they did not seem to check me. I whistled again; still the speed kept up. I gave the third signal for brakes, and then reversed my engine, saying to her: 'Do your duty, my beauty,' or in twenty seconds it is good-by to railroading. We came to a standstill eighty rods from a train on the main track, having run one mile and a quarter from the place where I first discovered the red light. A locomotive engineer, to avoid trouble, must take time by the forelock—in other words, must anticipate possibilities."

In 1849, Mr. Thomas Rogers, of the Rogers Locomotive and Machine Company, introduced the link motion in his practice. Other builders, however, strenuously resisted the innovation, and none more so than Mr. Baldwin, of the Baldwin Locomotive Works, Philadelphia.

Mr. Rogers may be fairly said to have done more for the modern American locomotive than any of his cotemporaries. In America the standard wood-burning locomotive stands precisely where he had brought it in 1852, and where he left it at his death, in 1856. His influence thus strongly exercised was not that of original invention, but of sound judgment—a practical appreciation of what was best among all the diverse details of construction which he had found in the current practice, or which arose in his own effort for improvement.

A 3-Cylinder Locomotive.

Since the publication, in November, of the fact that there were in use 3-cylinder locomotives, we have had several requests for working details.

These locomotives were designed and patented by John B. Smith, now president of the Erie & Wyoming Ry., in 1880. They have three cylinders, each 8" bore by 12" stroke, four driving wheels 34" diam.; steam ports $\frac{3}{4}$" by 6", $\frac{1}{4}$-inch lap of valve, one inside connecting rod, two outside connecting rods, and weigh 4 tons.

It is claimed that these engines have hauled 98 tons up a grade of 45' per mile, at a speed of 8 miles per hour, with 130 pounds of steam.

Suppose you are standing on the left side of engine; Fig. 1 represents the piston of main rod and side rod on the right side; Fig. 2 the center engine and its connections, and Fig. 3 the left engine and its connections.

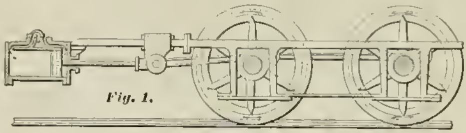


Fig. 1.

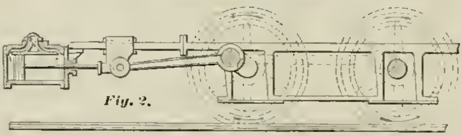


Fig. 2.

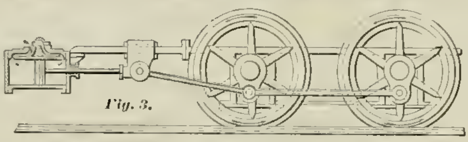


Fig. 3.

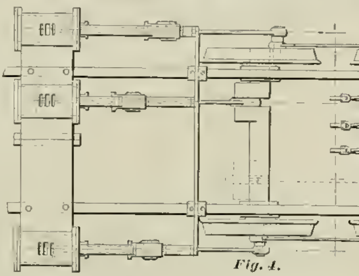


Fig. 4.

Fig. 4 is a plan showing the location of the cylinders, the three sets of eccentrics, and the inside side rod.

The inside cylinder is placed out of the center, so as to make room for the inside paralleled rod. From the illustrations the whole plan will be plain to any mechanic.

Positively the Last

GRAND TRUNK.

It is very rare with our Standard engines to interfere with steam-pipe rings, as the pipes are so constructed that flues can be taken out without interfering with pipes.

Some engines have been running here over five years, and rings have not been interfered with.

When they require doing up one advanced apprentice can do them easily in ten hours, at a cost of from 80 cents to $1. W. D. ROFF,
Belleville, Ontario. R. H. Foreman.

Your letter of the 25th, addressed to me at Fort William, received to-day. In reply I would say that, during my time there (four years), in no one instance were steam pipes removed for the purpose of remedying a leak, as none existed. The engines principally in use there are built by Dub & Co., Glasgow. The steam pipes are held in place by four bolts at either end, with rings of very much softer metal than in general use on American engines; that is, a larger proportion of copper. The round joints to all appearances had never been ground, as, when removing pipes in several instances to take out tubes, the tool or "chatter" marks in the sockets were plainly discernible on the rings; the flat surfaces appeared to have been well faced and ground. In replacing the rings, the flat joints were ground and the circular joints were cut down to a bearing not more than $\frac{1}{16}$" wide, which was not ground, but crushed by the force of bolts to place. I have never tried it, but see no objections to making the joints on both sides of the ring in this way. A. F. PRIEST,
M. M., E. Ry. Co. of Minn.
West Superior, Wisconsin.

LOUISVILLE & NASHVILLE.

Grind when found leaking—generally indicated by engine not steaming. Have done the work and sent engine out in eight hours, estimated cost, $5.
C. F. GILES, M. M.
Pensacola, Fla.

About once in two years; never had occasion to do this work after engine was in road service. Time, about ten hours, steam and exhaust pipe; skilled labor not necessary, use a helper. Cost, steam pipes, $1.75. THOMAS WALSH,
Mt. Vernon, Ill. M. M.

KEOKUK & WESTERN.

Only when engines go in for repairs. An apprentice and helper only on this work, time, six days for all joints from the throttle to the exhaust.
Foreman in charge, K. & W. shops
Centerville, Ia.

OREGON SHORT LINE.

No general rule; most of our engines run till flues are changed. Time, 5 to 12 hours, depending on condition of joint. Cost, from $3 to $5.
G. SPOUGBERG,
Montpelier, Idaho. R. H. Foreman.

LAKE ERIE & WESTERN.

Very seldom, except in back shop. It takes two men about twelve hours; machinist and helper, $5.10; boiler maker, $1.25. A. A. ORR,
La Fayette, Ind. R. H. Foreman.

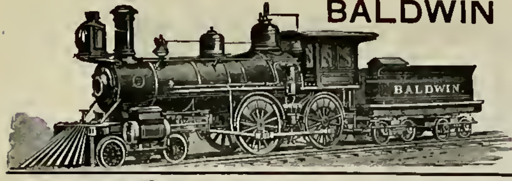
CHICAGO, MADISON & NORTHERN.

About once a year; have a special set of wrenches for this work. Time, ten hours; cost, $4.
STEVE H. O'NEILL,
Freeport, Ill. R. H. Foreman.

NEW YORK, LAKE ERIE & WESTERN.

Grind in once in six months; sometimes they last longer; time one day. Cost about $3.70. G. W. NORRIS,
Carbondale, Pa. R. H. Foreman.

The Brotherhood of Engineers of the A. T. & S. F., at Newton, Kan., recently held a largely attended ball, the proceeds of which they will devote to the establishment of a new lodge.



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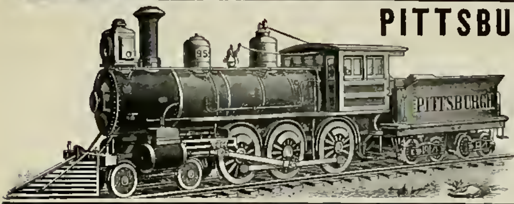

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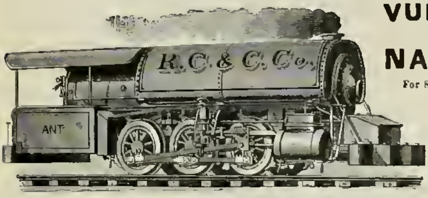

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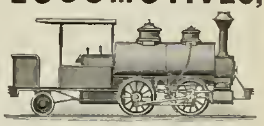

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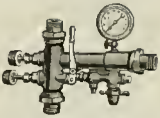

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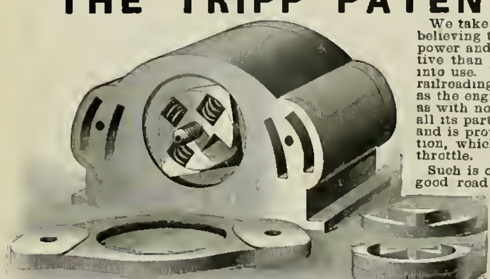

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The Locomotive Engineer.

Devoted to the Special Interests of Locomotive Engineers and Firemen and to Locomotive Maintenance and Repairs.

VOL. II, NO. IV. NEW YORK, APRIL, 1889. $1.00 per Year. or 10c. a copy.

A Long-Felt Want.

This item is written with a pencil sent out by Pedrick & Ayer, Railway Repair Shop Tools, Phila., and bearing their ad. on its sides and a nickel-plated rubber tip on its north end. What the roundhouse and repair shop foremen of the country want is a pencil with an 8x10 swab on top, that will take finger marks, abbreviations, elbow prints and tobacco juice off the work book, and keep 'em off. If Pedrick & Ay——there, lead broke.

Arizona has passed a law making train robbery a crime punishable with death. Train robbery is petty larceny as compared with train wrecking. The deliberate placing of obstructions on a railway track is to all intents and purposes attempted murder, and should be dealt with as such. Dealing with train robbers and train wreckers is like cooking rabbit—first get your rabbit.

The conductors and other trainmen on the Mobile & Ohio road have been provided with Winchester rifles to protect their train from robbery.—*Conductors' Monthly.* Good chance for the conductor to get his work in on the spotter—but the spotter is after train robbers too.

The *Railroad Patriot*, late of St. Joseph, Mo., was only in a trance, and has come to life at Denver, Col. Its epitaph is not yet cut, and we hope it never will be. The *Patriot* proposes to look after western railroad news and fight for fair pay, reasonable hours, and against detectives and spotters. Success to it.

The Webb Compound Locomotive.

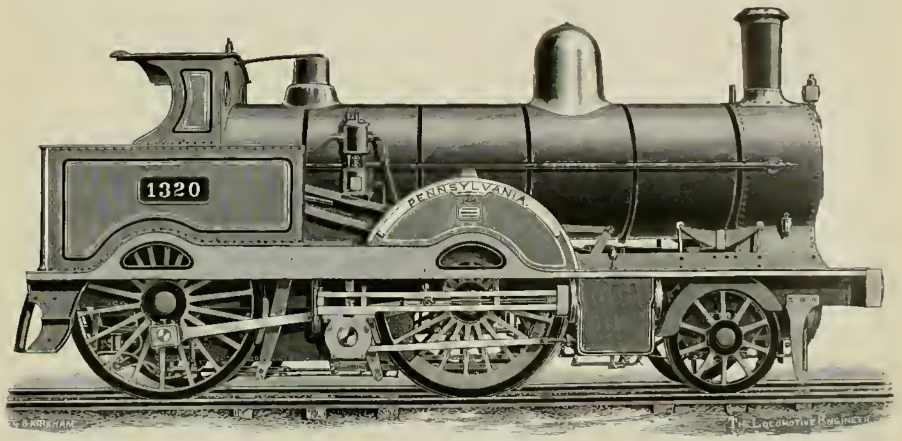
The Webb Compound Locomotive has arrived from England, and is being limbered up on the P. R. R., at Altoona. Through the courtesy of Mr. F. L. Sheppard, Superintendent of Motive Power, the editor of this paper was given a chance to inspect the engine in the shop and ride on her over the road, and the following description, comments and criticisms are from an engineer's standpoint, and in comparison with American locomotive practice.

The principle of the compound engine is to take the exhaust steam from one or more cylinders and use it in another or other cylinders. In the Webb system two high-pressure cylinders exhaust their steam into the chest of one large, low-pressure cylinder. The engraving on this page represents the engine just as she was on her arrival. Since she was put in service the large hooks, or life guards, as they are called, in front of her leading wheels have been removed and a P. R. R. standard pilot put on, the small head-lamp has been replaced by a somewhat larger one of the same pattern with a gong behind it, with a bell cord to the cab—there are no bells on English locomotives, a small whistle being used instead. The tender has also been fitted with a scoop, to take water while running, and a Janney draw head.

The high-pressure cylinders, 14 x 24, are located between the drivers and are coupled to the back pair of wheels—no side rods are used. The low-pressure cylinder, 30 x 24, is located under the smoke arch, and the main rod coupled to a center crank in the forward axle.

Both pairs of driving wheels are 75 inches in diameter, the leading wheels 44—with this system it is not necessary that both pair of drivers should be of the same size.

Steam is sent from the dome through the front end, down beside the low-pressure cylinder and back to the high-pressure chests—which are underneath the cylinders—through a pair of 3¾ copper pipes. The exhaust steam from the two smaller cylinders is carried to the smoke box by a pair of 5-inch pipes; these enter the front end at the bottom and are carried in each case entirely around the inside of front end and enter the top of the low-pressure steam chest. In operation, steam is admitted to the high-pressure cylinders and exhausted into the low-pressure chest to further expand and do additional work. Only the exhaust of the low-pressure cylinder is heard or has action on the fire, and it sounds very odd to hear the exhausts so far apart at high speeds.



There is a gauge in the cab, that registers the pressure in the big cylinder, and we noticed that, in working hard on the heavy grade out of Altoona west, that this pressure was from 30 to 40 pounds when the steam was following the piston in the high-pressure cylinder for about ¾ of the stroke—the low-pressure cylinder being worked full stroke all the time.

The valve motion is of the Joy type, much used in Europe and peculiarly adapted to these engines. Fig. 2 is the adaptation for the inside cylinder, and is like that on the outside cylinders, except the latter is turned upside down to get the motion to valves, as they are under the cylinder.

The diagrams will make the motion clear—the rods are hid in the large engraving. The Joy gear has no eccentrics, return cranks or other actuating motion on the axle, but takes all the motion from a pin located near the front end of the main rod. In Fig. 2 the motion of the main rod is repeated on a smaller scale by the arrangement of linked rods; the lower or radial rod being fast to the back head of the cylinder, the motion of the rods simply shoves a die block up and down in the slotted block shown; to this die is fastened the valve rod, and it is plain that if the slot were straight up and down no motion would be given to the valve stem; but, as it is inclined, the rod will have a motion forward and back, and if this motion cuts off the steam properly when the top of the link is inclined toward the cylinder it will be reversed when it is inclined from the cylinder, the reversing is done and the travel controlled by changing the position of the slot. In the outside arrangement the slot is hung in the center of the motion plate shown under back end of guides, and the motion controlled by swinging the block containing the slot. Fig. 3 shows the arrangement of this motion.

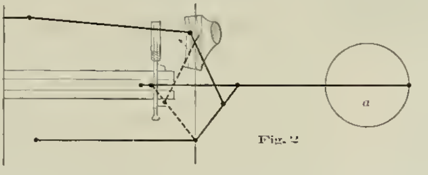


Fig. 2

This engine weighs 99,000, about 27,000 of which is on the leading truck wheels and the rest on the drivers. It is evident from the way the engine rides, and the ease with which the back pair of wheels slip, that there is much more weight on the forward drivers than on the back pair; this seems to us a serious fault, as the back wheels slip badly on the start, and, if the low-pressure piston is on the center, the engine is very slow to move—indeed, she was recently stuck at the coal chute under these circumstances while light. In starting, the train is jerked severely when the low-pressure cylinder takes steam.

The cab is the most interesting part to an American engineman; this engine's cab is only different from the regulation English engines in having the reverse gear on the right side.

The high-pressure valve motion is handled by a screw-wheel in the corner of cab, and the low-pressure by a lever located back of the engineer—in most of the engines on Mr. Webb's own road the gears are connected and handled by one motion—which would seem a much better arrangement, yet by the present plan the low-pressure cylinder can be full stroked, while in the high-pressure cylinders steam is being worked expansively.

The throttle, or regulator, stands up at the front and top of boiler head, and has a motion from the engineer to open, looks like a grindstone crank, and is worked wide open. On each side of it there are water glasses—no gauge cocks used. On the outside of the glasses and near the water line are located the checks, with large hand wheels over them to force them to their seats, if necessary, the feed pipes come up from underneath the deck and the delivery or branch pipes extend from the checks through the boiler to near the front.

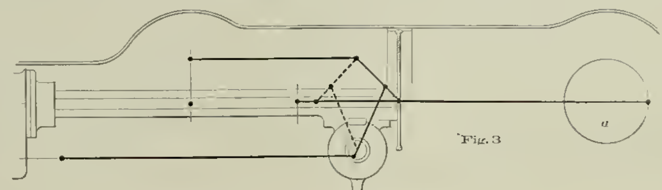


Fig. 3

The engineer's brake valve is located in front of the runner and just above the screw reverse gear, the air gauge being located on the front of cab on the right side, the steam gauge on the left—pressure 180—and the low-pressure gauge on the right side of the cab. In front of the engineer is located a lever that is used to open communication between the high-pressure exhaust pipes and the atmosphere, as without this the engine will not drift down hill very fast, as the pumping action of the pistons creates vacuum enough in the high-pressure cylinders to check the speed.

On the boiler head is one oil cup with pipe running through boiler to oil the valve of low-pressure cylinder, the cups for high-pressure cylinders being on running board outside.

There is also a lever on the right side to open a small steam connection to low-pressure cylinder to warm it up, and possibly help start.

Below the screw reverse and on the deck is a lever to open some very large cocks on the steam chest, exhaust pipes and connections under the engine—there are 14 cocks under the 3 cylinders and their connections, with several levers in the cab to manipulate them.

On the foot plate is located two levers for controlling the foot cocks to injectors—these are Gresham non-lifters located under deck, and on this particular engine are too large or have little range, as they had to be worked full, and then shut off—a method of working that makes it very hard to maintain an even boiler pressure. Modern injectors with range to suit the requirements of the engine would do much to make the engine more satisfactory in its steady steaming and water carrying.

The fire-door opens inwardly from the top, thus becoming a deflector when open, it is handled by a short lever with a spade handle located on the left side and above the door, it will remain open any degree as set on the quadrant, but automatically closes by merely releasing the latch. The door proper is a simple casting without machine work—easily replaced for a few cents. This one was red hot all the way up the hill, but we are informed that they run from three to eight months without renewal. The cab lamp is located on a shelf just over the door, and does not show any of the gauges or water glasses. On the back of cab roof there is a small piece of bright tin supposed to reflect the light from door upon the gauges—in England they use a mirror for this purpose.

The edge of the cab all around is an oval section of finished iron, the cab proper is of ⅛-inch steel painted black outside and drab inside.

Immediately over the center of boiler, and forming part of cab, is a box containing both whistle valves and both injector throttles, with their four levers extending into cab; just outside of the cab is a pair of encased Ramsbottom pops. The seats are plain plank, too low to sit on with comfort—there is a book of rule order on the home road of these engines, London & Northwestern, that the crew shall not sit down.

The running board is wide and the cab narrow, the engines being easy to get about over, no wood is used except a temporary wooden desk. The boiler is covered with a wire air space and a blanket of asbestos cloth, and then a jacket of ⅛ steel sheets painted jet black with a very light red stripe along the edges of the bands.

The front end and doors are models of fine wrought-iron work, and the excellent finish and plain paint of the whole engine is of a nature that gives the machine the appearance of thorough excellence in workmanship and material, not seen in this country—there is nothing fancy, not a single piece for appearance.

In front of the forward wheels will be seen some large pipes extending nearly to the rail; these are open in the front end and used to carry off cinders.

The engine is provided with independent sand pipes for both pairs of drivers, and also has a pair on front of tender, to use in backing up.

The round glass windows in front of cab are hinged at the top, and can be fastened to top of cab in pleasant weather.

On each driving wheel cover is a brass box with oil pipes leading to the driving boxes, with cocks to control the flow of oil—there are few, if any, points about the engine that cannot be lubricated while in motion.

The wheel centers, crossheads, motion plates and in fact most all the pieces usually made of cast or wrought-iron, are made of cast-steel. Just back of the stack there is a safety valve that prevents a pressure of over 75 pounds from being reached in the low-pressure chest.

The driving boxes are solid and have no wedges.

The front truck is of a peculiar construction patented by Mr. Webb. The boxes on both sides are fast in a heavy wrought yoke extending across the engine frame from side to side; this double box casting does not cross the frame in line with the axle, but is itself a segment of a circle struck from the center of the frame some distance back of itself, thus, when the engine strikes a curve the swing of the axle advances the wheel on the outside of curve and retards the one on inside, this swinging frame has a motion each side of the center of about two inches, and is held centrally by huge coil springs under the center of axle and fast to the frame of engine. The engine curves very well.

This locomotive was not made at the London & Northwestern shops at Crewe, but by Beyer, Peacock & Co., Ltd., Manchester, Eng., and was sent out in charge of one of their machinists, Mr. Ned Barker, who set the engine up.

The L. & N. W. road sent an experienced engineer, Mr. Benj. Hitchen, who has been running on that road for more than 30 years and handling compounds ever since they were put in service. Mr Webb is to be congratulated on his selection of this engineer, as he is a whole-souled railroader all the way through, with none of the bluster and blow that usually characterize English mechanics sent to this country. He sees the case as it is, comments intelligently on the difference between our practice and theirs, and has as many warm friends among the Altoona engineers as anybody could have in the time he has been there. The repairs of the engine are under the charge of Mr J. E. Howard, a young English mechanic, who has been for some months an employe of the P. R. R., and who is thoroughly familiar with the compound system, from having worked on the engines in Europe; he is a good match for engineer Hitchen, and carries a very good brand of cigars.

The engine is handled, and very nicely, by engineer Hart, the duty of the English engineer being simply to ride on the engine and see that the boys don't get stuck. There is a chance for this among all the handles used.

The compound is only being "limbered up" on the hill, and will be tried on trains and track better adapted to her construction. She should show up the best on the division between New York and Philadelphia, where it is comparatively level, and on trains making the fewest stops—the start is where she loses time and jerks badly.

On the trip up the hill the throttle was wide open, yet the engine steamed well, standing up at 180 with remarkably light firing, what she will do alone with a fast train remains to be seen.

It is our humble opinion that this engine will not be counted a success on our roads, and do not believe that the P. R. R. will buy or build any more of this particular kind. We hope that if she does fail to do all claimed for her that it will not condemn compounding in this country. If a compound engine were built with but two cylinders, and in the same place they are, on our ordinary engines, with rods, pins, etc., of the same weight on both sides, but one cylinder much larger than the other, and there was provision made for working high-pressure steam, through a pressure reducer, in the low-pressure cylinders, so that in starting and on heavy grades the engine would be to all intents and purposes the same as we now have, and then had provision for compounding after train was worked into speed, instead of hooking back till steam is cut off at 6 or 8 inches, and expanded down and released just as the pin is on the quarter and doing some effective work. By admitting the steam in the high-pressure cylinder for three-fourths of the stroke and then using it in the large cylinder, we ought to be able to do more work with less fuel and at the expense of no extra parts to keep up.

The tender is about the size and shape of ours on and above the deck, but a plate frame is used with three pairs of wheels, instead of our double truck. The gangway is wide, and a pair of rods extend from the deck to an extension of the angle iron around tank, that make very nice hand-holds. A screw brake is used.

The boiler is about fifty inches in diameter with a copper fire-box, 66 inches long. The boiler is built on Mr Webb's well-known plan—no foundation ring being used, but the water space extending clear around under the grates, doing away with the use of an ash-pan.

Of course the railroad boys could not see so strange an engine around without giving her a name, and the P. R. R's Webb compound will go down to history—among the rank and file—as "Jack-the Ripper."

The Strong in Actual Service.

The Strong locomotive, A. G. Darwin, recently built at Hinkley's, is now running on the Erie, and, so far as we are able to learn through the engineers and firemen, has not done any surprising work as yet. On long runs it is claimed that her fires clinker badly. She hauls one more car than the best engines, but this is a small increase of load for her extra size and weight. Some of her valve motion is reported light, with frequent break-downs. Of course the proper sizes for all parts of a new device cannot be established without trial, and the trouble now experienced may be overcome. The hauling of 30 loaded cars at the rate of 80 miles per hour, and the engineer *holding her back* all the time, that was promised by several railroad papers just after her trial trip, seems to be some distance away yet.

The Eclipse Lubricating Oil Co., Limited, Franklin, Pa., have issued a neat, leather-bound note-book, with patent removable pads. The book is intended as a memorandum for their oil-users, to whom it will be furnished free. Inside the cover they give directions for the use of their oils, and make the proposition that those doubtful of the merits of their cylinder oil try it for six months on one side of a locomotive, using tallow on the other, and decide on its merits this way. This seems like a fair proposition.

Alexander's Ready Reference tells engineers what to do in an emergency. Plain, short directions, without any superfluous words or explanations. The work is so small that it is easily carried in the pocket, and is always ready to help a fellow out in a break-down. We were surprised recently to see the record of sales. There must be thousands of these little books in the hands of our enginemen.

A correspondent sends drawings of a lubricator with a pipe attached to draw off the water of condensation without use of a dish or getting the boiler head dirty. If the makers do not put on drip pipes the men generally do. The device hardly needs illustration.

Judging by the way orders are now coming in for bound volumes for last year, the present edition will be exhausted in a few months, and the books worth $5 in a couple of years.

Balanced Valve Kink.

The Pennsylvania road are using a large number of Richardson balanced valves, embracing some new features, the ideas of assistant M. M. Jos Davis. They formerly had trouble with the balancing plate being sprung out of shape, either by its own four bolts or by the cover being sprung in bolting down, they believe they have entirely overcome this difficulty by holding the balance plate by a single central bolt. The long packing strips are grooved out slightly on top, leaving the edges about $\frac{1}{32}$d wide; this allows the strip to wear itself to a bearing sooner than if it was full width at the top. The long strips are also let into the end strips enough to make a side bearing on the corner joint as well as on end bearing.

A Packing Ring Kink.

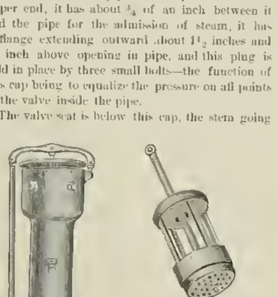
General Foreman Owens, of the R & D. shops at Manchester, Va., had some trouble with the blanks for cylinder packing rings springing—they hold them in a 3-jawed chuck—and overcame the trouble by having a brace cast at one end of the blank, as shown in the sketch. By placing the jaws of chuck opposite these braces the springing is avoided. The usual practice of casting lugs on the outside of blank, to bolt to face plate, is not so handy or as quick as the use of a chuck.

Lozon's Throttle Valve.

This valve is the invention of Chas. Lozon, a machinist in the Michigan Central shops at Detroit, and is described by him in substance as follows:

The straight stand-pipe has a cap fitted into the upper end, it has about ¾ of an inch between it and the pipe for the admission of steam, it has a flange extending outward about 1½ inches and ¾ inch above opening in pipe, and this plug is held in place by three small bolts—the function of this cap being to equalize the pressure on all points of the valve inside the pipe.

The valve seat is below this cap, the stem going



LOZON'S THROTTLE VALVE.

through it; the valve is loose on the stem and can turn around so that it does not necessarily seat itself in the same place every time.

The levers are so arranged that the valve is always lifted squarely from its seat.

The object of the invention is to insure a tight joint at the seat and make a thoroughly balanced valve.

Any further information can be obtained from the patentee as above.

The gilded walls of the sanctum of the philosopher of this sentiment foundry are now adorned with a large photo of Richardson's valve motion model.

During February the railroad across the Brooklyn bridge carried 2,540,564 persons and 167,613 walked across the foot-way.

A Fast Scotch Engine.

Mr. Hugh Smellie, locomotive superintendent of the Glasgow & Southwestern Railway, has recently built some heavy passenger engines that are making remarkable runs.

The distance from Glasgow to Carlisle is $115\frac{1}{4}$ miles and the time two hours and thirty minutes, less seven minutes station time at Kilmarnock and Dumfries, this is 49 miles per hour over the whole division, and the line has several long hills where the grade is one in sixty seven for several miles, and two five-mile stretches where it is one in one hundred. These engines are 8-wheelers, with 27,300 pounds on the truck and 57,200 pounds on the drivers. The cylinders are $18\frac{1}{4}$ x 26 and the driving wheel 80 inches in diameter. Length of ports 16 inches, travel of valve, $4\frac{3}{4}$ inches, lead, $\frac{1}{8}$ in full gear, lap, 1 inch. The valve travel and length of parts is much less than usual American practice.

The designer of this engine believes that for heavy service, long stroke and large wheels do much better than by reducing the size of wheel and running at excessively high piston speed, and the success of his engine seems to bear him out. It has long been the opinion of the writer that American freight engines would do better work with longer stroke and larger wheels, they would not have to make the turns in a mile, would ride easier, last longer, be easier on their valve motion, journals and the track.

The boiler of Mr Smellie's engine is but 50 inches in diameter with a fire-box $62\frac{3}{4}$ inches long by 40 inches wide, containing 106 square feet of heating surface and $17\frac{1}{4}$ square feet of grate, with 238 $1\frac{5}{8}$-inch tubes, containing 1,082 square feet of heating surface. This boiler would be considered small in this country for the cylinders used.

Air Brake Practice.

BY J. E. PHELAN, M. M.

About air brake appliances nothing at present seems more interesting than the new engineer's brake and equalizing discharge valve. This is the latest indulgence in improved design for the purpose of automatically assisting the engineer to apply brakes moderately and skillfully for ordinary stops.

The principle of the original engineer's brake valve and its later improvements, embodying the 20-pound reserve principle, are all preserved in the engineer's brake and equalizing discharge valve. But in outside appearance and inward design radical change is apparent. This new engineer's brake and equalizing discharge valve seems to have added the automatic principle of the triple valve to its mechanism, *i. e.*, the principle of the greater pressure controlling the lesser.

Where valves in the engineer's valve or 20 pound cock are held to seats by springs, valves in the new design are held to seats by air pressure, excepting the 20 pound reserve or feed valve, which is held to its seat by a spring.

This engineer's brake and equalizing discharge valve was started in at the Burlington brake tests, but has undergone two changes in design within its mechanism since. We will attempt to explain the latest design first, and make notes in retrospect concerning the two of previous design.

The main purpose of this new valve seems to be to insure a more easy and uniform application of brakes the entire length of cars, or brakes in use, and by establishing an easy and gradual reduction of air from train pipes to atmosphere, avoid the sudden reduction of pressure from forward cars, and consequent release of brakes by concussion of air from rear cars.

How this automatic reduction of pressure from train pipe occurs will appear further on.

The engineer's brake and equalizing discharge valve, now being furnished by Westinghouse Co., is comparatively simple and effective.

In action its parts for controlling air pressure commence with the handle and handle spring, same as in common engineer's valve, or 20 pound cock. This connects on with rotary valve key, which acts in placing rotary valve in position, as indicated by position of handle. The rotary valve comprises the functions of the former top valve and main valve of 20 pound cock. Below the rotary valve is the air chamber of valve body. Attached by piping to this chamber is a small auxiliary reservoir for purpose of adding air capacity. Below the chamber is located the piston valve with ring, similar to any piston in principle, fitting into cylindrical part of valve body connecting to train pipe. The lower end of this piston and rod forms a seat on a projection from side of body and leading to opening to atmosphere. This piston valve is the part acting automatically when brakes are applied in service stops.

Then we have the 20 pound or feed valve, set in independently at side of valve body. This comprises the mechanism of the engineer's brake and equalizing discharge valve.

A former design of this device had openings through piston for air to pass into train pipe from source of supply—these openings being controlled by a check valve and spring fastened to rod on lower side of piston. There is also a stop-cock on side of valve body to control opening to atmosphere. This was intended to be closed by hand in event of any substance lodging under seat of piston valve and preventing its closing. It should be borne in mind by those handling this class of engineer's valve, that this stop-cock should be left open when operating the brakes.

The engineer's valve in use at Burlington tests, in addition to above had a slide valve attachment on piston rod, somewhat similar to slide valve of triple valve.

But let us return to rotary valve as moved and controlled by engineer's valve handle. This rotary valve controls the ports and acts in principle as the common plug in engineer's valve, or as the main and top valves in common engineer's valve, or 20 pound cock.

You can note that on common engineer's brake valve, the main reservoir pipe connects on the bottom, and train pipe connection comes in on side of valve body; while on the engineer's brake and equalizing discharge valve, the main reservoir pipe connection comes in on side of valve body and delivers air from main reservoir to top of rotary valve, while train pipe connects at bottom of valve body. In old design, air passes down through rotary valve, thence through piston and past check valve, in reaching train pipe and auxiliaries. In latest design air passes through passage known as direct application port in reaching train pipes and auxiliaries from main reservoir. This direct application port is formed inside of valve body similar to passage leading from main reservoir on sides of valve body. The passage from main reservoir leads into valve body over the rotary valve; the passage to train pipes, or direct application port, leads down from rotary valve seat.

Let us move the handle of the engineer's valve as far as handle spring will allow it to go toward the left. This is known as release position. In this position main reservoir is in full opening and communication with train pipe and auxiliaries. Take the rotary valve and examine its face; you will find a fair sized blank cavity cut into its face. You will find near one end of cavity, but separated from it by bridge on face, a port of oblong shape; this port passes through the rotary valve. By examining valve seat, you will find a blank cavity in seat directly under this supply port, and when in release position, practically a part of it. The supply of air from main reservoir, coming in on top of rotary valve, passes down through this port into the blank cavity, on seat, and passes along this cavity past the bridge, and then flows up through the hollow or cavity in valve face, until it reaches direct application port, or train pipe opening, when it flows thence into train pipe and auxiliaries. This gives a direct and free passage of air from source of supply to train appliances.

We will now move handle to position while running, by bringing handle spring to first slot to right of release position. In this position 20 pounds air, more or less, will always be retained in main reservoir, over and above amount of pressure transmitted to train appliances while handle is in this position. When in this position you will notice the supply port cut through rotary valve simply feeds into blank cavity in valve seat, and has no further outlet. But near side of rotary valve you will find a small round cavity running through the valve, and when in this position this port lays directly over a similar port in valve seat. Through these ports air passes down through small passages cored in side of valve body, passing 20 pounds or feed valve, thence by this cored passage into side of direct application port or passage leading to train appliances.

To the right of this feed port in valve face, is another port of similar size leading through valve seat. This is intended as an equalizing port, and acts in supplying chamber, and small auxiliary reservoir connected with chamber, with air. It also supplies pressure on top of piston valve, and keeps this valve on its seat. Air flows to this equalizing port from train pipe, through cavity in rotary valve face, when handle rests in release, or feed position, while running.

To the left of the feed port in side of valve seat you will find two small round ports close together. One leads to atmosphere and the other through valve seat to chamber. We will now move handle around to position for application of brakes, service stop. In this position, handle spring resting against stop at the right of middle guide-way, you will find that air is shut off from feeding through equalizing port, and that it flows from chamber and small auxiliary up into a small, narrow groove or cavity in side of rotary valve face. This cavity at one end (when handle in service stop position) connects at one end with port from valve chamber and at other end with atmosphere; hence air passing into it from chamber passes directly through the opening, into atmosphere, or through the preliminary exhaust port. When from 3 to 8 pounds of air has escaped in this manner, turn handle to left until handle spring rests against stop to left of middle guide-way. This is on lap or blanked position, where all communication between ports controlled by rotary valve are shut off. The amount of air escaping from preliminary exhaust simply escapes from the valve chamber and small reservoir. This reduced pressure on top of piston valve allows air from train pipe to force it off its seat and escape past uncovered seat into atmosphere, through application port in side of valve body at lower end. When an amount of air has escaped from train pipe by piston valve opening, equal to that having escaped from preliminary exhaust opening, the piston valve should return to seat automatically, while handle is yet on lap or blanked position. But you may find that if considerable air has escaped from preliminary exhaust, the piston valve seems tardy about returning to its seat and shutting off the automatic flow of air. This can be easily controlled and remedied by pushing handle and spring a little past the stop to left of middle guide-way and holding it midway between lap and feed positions for a moment or two. This brings action of air from train pipe to bear through equalizing port, and, acting with pressure remaining in chamber and small reservoir, quickly seats the piston valve. But if air is exhausted from preliminary exhaust port very lightly, this necessity may be avoided.

We believe that handle of engineer's valve should never go past service stop position to the right, except to avoid accident.

In position for application of brakes for emergency stops, or with handle spring resting against stop to extreme right, the blank cavity in face of rotary valve connects at one end with train pipe ports and at the other with direct opening to atmosphere at back of valve body. When in this position air flows freely and directly from train pipe to atmosphere, and acts as our Western R. F. recommended, "alle same bursting a hose."

Principle of action with this engineer's brake and equalizing discharge valve when connected as double-header in mountain service, etc., should be treated here, but will come in with future paper.

Hassman's Tire Heater.

The tire heater here shown is the invention of William Hassman, M. M. of the Richmond & Allegheny Ry., at Richmond, Va.

The device consists of a tank, generally an old air drum, filled with some porous material—sponges, etc., generally excelsior—and the air pipes.

The pipe and hose provided with coupling head is attached to a locomotive train pipe hose and the supply of air furnished by the pump, this pipe goes nearly to the bottom of tank, the pipe to hoop is tapped into the top and has a check valve near the tank to prevent air from entering the drum. In use, the tank is partially filled with hydro-carbon liquid—preferably gasoline of 86° fire test—the hoop with perforations for flame jets adjusted to the tire to be expanded, and the air pressure turned on. The air agitates the liquid, and rises up through the saturated porous filling, and appears at the flame jets as a highly inflammable gas which burns freely.

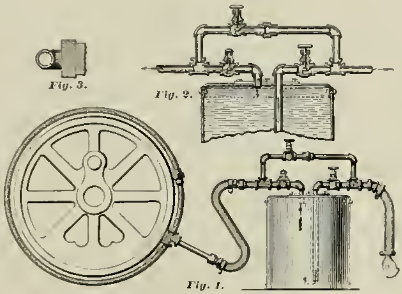


Fig. 3. *Fig. 2.* *Fig. 1.*
HASSMAN'S TIRE HEATER

In adjusting new work, when the tire is expanded and in place, the valve in the air supply pipe is closed, and that in the top connecting pipe opened; this shuts off the supply of gas, and sends a blast of cold air directly on the tire, thus cooling it uniformly and quickly.

As will be seen, the device is extremely portable—in fact the whole apparatus can be moved about the shop on a barrow or truck—it is made of material always on hand about railway shops, and is therefore cheap.

Fig. 3 shows a brace to keep the tire at proper distance from hoop, and the method of piercing hoop to insure a wide heating surface.

Headlight Signals.

The Baltimore & Ohio R. R. have adopted a new scheme for signal lights on their locomotives which has merit in it.

On each side of the front glass in the headlight, in the beveled ring that holds the same, is set a bull's-eye lens at an angle of about 45°. These are provided with hinged covers to close and make a dark lantern with red glass in, to use when a section is following. They use them dark when running "wild."

With this arrangement there is no danger of the signals going out unobserved; the head lamp furnishes light for all three, and, should that go out, the engineer is apt to discover the fact some time before morning.

[A subscriber sends us the above item; we would say, in addition, that this style of signal lamp is in use on several western roads, and while it has merit, it has a serious fault. The bull's-eye can only be seen from the front of the engine, and when the wind is blowing steam and smoke ahead, or when it blows the steam and smoke from the engine on siding it hides them from view. If the tin ring between the headlight case and the bull's-eye were replaced by a ring of red glass, the signal could be seen from in front, the side, and some time after the engine had passed the observer.]

The P. R. R. folks are working on the drawings of an American Compound.

Correction.

Last month, on page 5, the types made our correspondent, C. F. Richmond, say that he set up a valve motion model so that it gave "exactly equal *cut-off* for every position of lever." He wrote *travel* instead of cut-off; it is impossible with the link motion to get exactly equal cut-off for all positions of the reverse lever.

Bending Iron Branch Pipes.

Just why copper branch pipes should be used for pumps and injectors is not clear. They are very expensive and hard to keep clean if left bright, and look no better than iron when painted. Iron pipes look clumsy when put up with elbows, but when neatly bent they are as sightly, stronger, cheaper, and just as good for the purpose as if made of sterling silver. Some very neat work in this line is done at the Manchester shops of the R. & D. road; they bend their pipes by filling with sand, plugging up the ends and heating.

The Pennsylvania Steam Car Heater.

The system of steam heat for cars that has been recently tried on the P. R. R. (it is said with success) is what is known as a circulating system. Steam is taken from the boiler, and also the exhaust of the air pump, and goes through the coils or radiators in the train; there is another and direct line of pipe and couplings from the rear car back to the locomotive. On the locomotive is a steam-driven, vacuum pump (its exhaust pipe also leads into the heater pipe), which keeps up a partial vacuum in the return pipe; this draws back all the water of condensation to the tender. In cold weather this pump will keep up a continual flow of steam through the whole system, the return steam being condensed in its receiver, in the water-tank. It is believed that this system will be adopted by the Pennsylvania.

India Items.

We are under obligations to Mr. Fred W. Bedford, locomotive foreman (M. M.) of the Great Indian Peninsular Railway at Sohagpur, C. P., East Indies, for photographs, of some of the engines under his charge, and also one of the India Midland. The G. I. P. engines are 17x22 outside connected, and built by Dub & Co., of Glasgow. Their chief peculiarity is the cab, being simply an iron canopy over the men, much resembling the roof of our cabs, the sides being provided with curtains.

The I. M. engine is an inside connected 8-wheeler, by Kitson, the front truck being mounted on roller bearings.

Two views of a derailment also accompany the others, derailment caused by a cut rail, but the native "driver" having been declared asleep, be was fined £2.

Brewer's Lathe Chuck for Turning Eccentrics.

The device shown is a lathe chuck for turning eccentrics, designed and patented by W. T. Brewer, a machinist employed by the Savannah, Florida & Western Ry., at Waycross, Ga.

The device consists of a circular face plate with a slot cut through its center. To this face plate is secured by means of four T-head bolts, an eccentric plate provided with a rib on rear side, which engages and works in slot and guides eccentric plate on face plate.

The eccentric plate is adjusted on the face plate so as to arrange it either concentrically or eccentrically, by slacking the -head bolts (which work in slots in face plate) and operating screw. The eccentric plate has a pointer which is adapted to sweep over the scale and indicate exactly the position of eccentric plate on face place. In securing the eccentric which is to be turned on the eccentric plate, it is placed thereon, and the bolts, which have their heads secured in countersunk recesses, are passed through openings cast in eccentric. Clamps are then placed on and nuts tightened.

The use of this device is obvious to machinists. An eccentric is bored and turned at any desired throw without moving work, but simply by operating screw. This device requires no mandrel, a feature not common in similar devices. No laying off of throw is required, this being done by pointer when screw is operated. It is claimed that an eccentric can be completed easily in two hours by any ordinary lathe man. No bent tools are necessary, as the face plate is only a very little larger than eccentric. If desired, two castings may be clamped together and turned simultaneously.

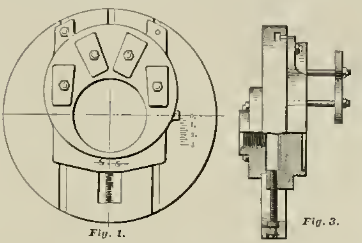


Fig. 1. *Fig. 3.*

Brewer's Eccentric Chuck.

Correspondence

A Pair of Kinks.

Editor The Locomotive Engineer:

The engineers on the D. & H. R. R. used to have some trouble with their signal lights going out when running at 40 miles or more an hour, and one of them, George Hydorn, got up a little rig to hold the lamp steady on the pilot. It was a circular piece of iron for the lamp to set on, and three lugs to hold the flange of lamp stand; two of these were riveted fast, and the third had a sliding motion toward the center and held in by a spring—just like the catch on a cupboard door. The boys say the lamps do better, and do not jiggle themselves out. George has a set of tin flags, red, green and white, with his engine number painted on them; these are kept painted bright, never wind up around the staff and hide, can be washed off when "showered," and are always in sight when out.

These flags have loops to slip over stationary staffs, can be kept under the headlight if necessary, and don't flap themselves loose and blow away like rags, and thus are cheaper and better. The flags are neatly bound with $\frac{1}{16}$ wire, and are as neat as new after six years of service.

Trojan.

John Alexander's Confession.

Editor The Locomotive Engineer:

Dear Sir and Fellow Sufferer I am sitting by the parlor stove at the stilly hour of 3.10 A.M., warming my uncovered shins and a bottle of condensed milk and keeping cases on four chairs full of little white flags of unbleached muslin—white denotes safety. But if it is safety for a fellow's wife to up and have a bran new baby eleven years and four months from the last, and after saying upon her word and honor 9,000 different times that she wouldn't, why, white flags are wrong—ought to put out red to signify "stop," or at least green to signify "run slow, look out for obstructions." But this idea of blocking the crossing of a man's life with a ten-pound obstruction and then swinging him down with white flags after he has got his pony truck under the fire-box, his boots full of boiling water and a reverse lever jabbed into his vitals, is mighty poor railroading—but Mrs. A wouldn't make a railroad man if she lived forever, ain't built right.

It isn't much use to go to bed, for I have to watch that little Alexander pretty close—got such an infernal small boiler that I don't more than get my eyes shut before the low water alarm begins to screech and I can shut it off only by putting a couple of gauges of condensed milk through the heater and into the slumbering volcano that turns its puggy nose up to the chandelier and don't care a continental dam whether I sleep now or next fall.

And now, as I have it cooled down again, both dampers shut and the door open, my thoughts turn back to the science and the rules and the whys and the wherefores of railroading.

If the laws of railroading are like those of nature and cannot be disobeyed without suffering for the disobeyer, then I ought to be in the pillory; for of all these laws, written and unwritten, I am here to confess there are none I have not broken. But if these laws are like those of the Creator, and can be forgiven or forgotten, why I want to confess right here and make you my agent—to give you the benefit of the commission and the experience—you may need to do some confessing yourself. I was just looking over my file of 1888, and I see considerable about reverse levers that you can adjust to a hair, then I have re-read my books on locomotives and other papers with one hand and warmed milk with the other, and in all of them the writers keep poking at the engineers of the country about using steam expansively and saving coal, etc. Then I shut my eyes and I see again the little old log Sunday-school up in the country, and the little old motto, worked with variegated stocking yarn in a perforated card-board, that hung over opposite me, when I used to be a good little boy that had to go where he didn't want—to that same S. S. That motto read, "Love your neighbor as yourself." Now both of these laws or theories are, to me, impossibilities. I never did my work honest on freight with the reverse lever nearer the center than would cut off steam at eight inches, and I never loved a neighbor hard enough to sit up all night and warm milk for his month-old baby.

Mr. Editor, did you ever run on a road where they run double-headers or where they have pushers? You have. Well, can you run your index finger along through your grimy brain and put it upon the memory of a man who always double-headed with the Johnson bar in the six-inch notch and the throttle in the tank? Can you shut your eyes now, scooch down your head to keep the cinders out of your neck, and, metaphorically, look ahead and see that engine hippity-hopping along on tiptoe, rocking from side to side and not pulling hard enough to get a porous plaster off a dead hen? Can you see his fireman sitting on the clothes-box throwing coal at the telegraph insulators with the coal boards all in yet, while your boy is scraping down the cinders from around the manhole of the tank?

Ah! you know him. You had just as lief have the dropsy as go out with him—so would I. Mr. Editor, I don't care a continental who says so, this idea of a full throttle and the reverse lever back of eight inches pulling a train is no good. The engines will not steam working this way, they won't pull, they ride harder, and they are seldom worked this way, eyether. Engineers are, as a usual thing, required to do a certain amount of work, pull so many cars at such a speed, and they are going to do it in the easiest and best way with the means in their hands—if an engine would do her work better on the center or in the corner, there she goes. I have always noticed that these wide-open-high-up men have to *abuse* their pet engines when they are running alone.

Now, I am not a full stroke fiend; I believe in working an engine as far back as she will do her work, steam well and make time.

If I was building freight engines, I would not have a notch between the center and $\frac{1}{4}$-stroke, then I would have them as close as possible. I would let the men put the throttle where it would do the work, but I would have the throttle valve in the nigger-head in front end It is all right enough for you fellows who are sitting behind a desk to write about full throttle and four-inch cut-off to us fellows who are pulling the trains—it is theory, and pleases those who are above us, and who think we are too lazy and stubborn to save twenty per cent. of the fuel when we could as well as not—but it won't do for me; my M M would be apt to call me up in his office and point out to me on the monthly performance sheet my four-inch cut-off coal bill with that of the man who don't believe in it, and ask me why I don't burn less coal.

I don't say you have got on this hobby-horse, but you will have lots of temptation to ride, but you keep right along with us fellows with overclothes on, and we will try every theory you ask us to, honest and fair, and we will do our work, take care of our scrap-heaps, make time and save all the coal we can—but we can't save it all and pull the cars, and we can't pull them with the reverse lever on the center.

Say, do you think opium in small doses, say four ounces every half hour, would make a healthy infant sleep and not impair its draught or circulation?

JOHN ALEXANDER.

On Burning Bituminous Coal.

Editor The Locomotive Engineer:

Average bituminous coal contains about 80 per cent. carbon, 5 per cent. hydrogen, and 15 per cent. of incombustible material, such as cinders and clinkers. In order to produce perfect combustion, sufficient air must be admitted to the furnace to combine with the gases, which are expelled from the coal. The amount must be determined by experience; if the supply is insufficient, some of the gases will escape through the tubes unconsumed; if too much is allowed to enter the furnace, the temperature will be reduced.

One writer on the subject says that every pound of average bituminous coal requires 1.8 pounds of air to burn its hydrogen, and 9.6 pounds for the carbon, so that the amount of air required for the combustion of average bituminous coal may be estimated at twelve pounds per pound of coal.

To produce the best and most economical results with the coal used in the Western States, the layer on the grates must not be too thick, the furnace should be fed with regularity, and three or four shovelsful of fuel at a time; the grates should be moved frequently to allow sufficient air to enter the fire-box, and to prevent the formation of clinkers on the grates, some of the air should be admitted above the fire-box to combine with the gases, which would otherwise escape through the flues unconsumed. After being as careful as it is possible to be, there is still an enormous waste of heat from the loss of unburned coal in the solid state, caused by the fine coal falling through the grates, being carried through the flues, and from the loss of heat by the hot gases which are carried through the smoke-stack. There is also considerable heat lost by radiation and convection from the different parts of the boiler which are not covered by lagging.

In regard to correctly supplying the 12 pounds of air required to combine with the gases expelled from 1 pound of coal in order to produce perfect combustion, it is a difficult matter to always regulate the supply to suit the demand. All experienced men know that on a road having grades, some eighty and others forty feet to the mile, causes the demands of a locomotive to be very irregular. At one time it is worked to the utmost of its capacity, at other times it is not worked so hard. The harder the work, the more coal is consumed, so, consequently, more air must be admitted to the fire.

This is my method: If the fire-box has got large grates, I do not admit so much air above the fire as I would if they were small. If the boiler is not making sufficient steam, I open or shut the front damper, or admit more or less air above the fire, and watch the steam gauge for the results. With small grates I always try to get about 20 per cent. above the fire—our fire-boxes are without arches or hollow stay bolts, but have got perforations in the door.

FRED TAYLOR.

Marion, Iowa.

Examination of New Men.

Editor The Locomotive Engineer:

I have been asked to give my views on the examination of a fireman, both before he goes on an engine in charge of the scoop, and afterwards when he is promoted to the other side of the machine, and the responsibility for the way it is handled.

When railroads were first operated in this country, firing or running a locomotive was an occupation requiring but a small part of the skill needed to-day. There were few trains on the road, the runs were short and in daylight only. Then it rose to the dignity of a trade, and, like other trades, had to be learned by both observation and experience before a man could be successful.

At the present day it is a science, and just as much one of the professions as law or medicine. Probably the lawyers and doctors won't believe this statement, but it requires just as high a degree of professional skill to handle trains nowadays as it does to perform surgical operations or divide up estates, and this skill can only be acquired by practice and experience, while it is certain that there are as many quack doctors and shyster lawyers disgracing their honored profession, to get along in the world, as quack locomotive engineers.

While the locomotive engineer may not possess the polish, or precise and eloquent manner of expressing himself on matters relating to his profession, yet he must have the knowledge and experience, or he will be a decided failure.

The engineers of to-day are aware that the uneducated man who does not try to find out "the reason why" of everything connected with his business, is falling behind each day, and cannot keep up with the procession.

Now, as the men who are made firemen to-day will likely be engineers at some future time, if the grade of the service is to be raised none but the best talent should be employed. It would be useless to employ a man as fireman to-day who has not the ability, when his time comes for promotion, to take charge of an engine on the main line, and handle a train with courage and discretion.

Therefore when a man presents himself for employment as a fireman, he should be required to make out an application in his own handwriting, stating his age, the occupation he last followed, and what trade he learned if he has one. This will look like red tape to some, but the only way to do away with extra red tape is to get a body of intelligent employes who have education enough to express themselves clearly, and not need a set form to assist their ignorance. An engineer of to-day must be something of a clerk, to make out the various reports and forms connected with his daily trips.

Then he should be examined in a common sense, way, without any doctors—professional scallops—to see whether he can tell a green flag from a blue or red one *every time*, and also if he is *dead sure* about the correct colors of lamp signals at night. If his eyes are weak or defective in any way, he should not be allowed on a locomotive for any purpose.

During the time he is firing, which will be three years, and on some roads where promotion is slow four or five, it would be a good plan for the M. M. or traveling engineer to ask him questions connected with his duties, not to puzzle him, but to find out what he does know, and to instruct him in what he does not know. Before he is promoted, even as a hostler or on a yard engine, he should be carefully examined by some one who knows how it is himself, about the rules, handling trains under various difficulties, train rights on the time card or with telegraph orders, what effect certain signals, when carried over any portion of the road, have on other trains; what to do in case of break-downs or wrecks, etc., and if he don't know *he should know before he is promoted.*

Some say that most of these things can be learned out of a book by a bright man so he can answer the questions better than some old engineers. Maybe so, but if all these things can be learned out of a book so easily, will not this same book help out his experience a little?

Because some men have made successful engineers who had little or no education, it does not follow that very many more will. If the natural abilities of the man had been aided by an education, he would have been even more valuable in his profession, and gone up the ladder higher than the usual round on which all engineers with no education must stop. There is always "room at the top," and if, by a careful culling out of the poor, inefficient men, who think they will be able to learn enough to run an engine, but never do, the grade of the profession is raised thereby, so much the better for both the employes and the corporations.

And right here I would say to those young men who are on the firemen's list, whether just employed or ready for promotion, study up the operations of your machine under all the varying conditions of every-day service. It is not necessary that you have hold of the reverse lever to know that the action of the links tends to pull it down in the corner, but it is necessary for you to think about it some before you find out why. If your engine does not steam well with a heavy fire and a large exhaust tip, why cannot a thinner fire be carried, instead of choking the engine down with a small nozzle so she cannot run at a good speed when necessary, in order to cut a fire that is two feet thick? There are lots of things that concern you more than being allowed to handle the engine when switching, or going to and from the coal dock and trains. It may be pretty hard work to find out some things from a man who never thinks for himself, but there is some one who knows enough to give you a pointer, and then exercise your own brains to some purpose.

There are lots of books on the practical operation of locomotives. Get them, read and study them, and if you only get a few ideas out of each one, it will set you to thinking, sharpen up your reasoning powers, and teach you that knowing something and having the "big head" are two radically different conditions.

The conditions of train service are growing more exacting every year, and the appliances devised to assist an educated engineer more numerous and certain in their action. So the old style of hiring a man to fire an engine, and if he is no good when he gets to be an engineer, turning him adrift to be a drag on some one else, must give way to the more intelligent plan of taking nothing but good material, treating it in an intelligent way, and making intelligent engineers that will be a credit to the profession, and the examination should disclose the amount of ability possessed by the fireman at the different stages of his service.

CLINTON B. CONGER,

Lansing, Mich. M. E. Ry. Com.

Probable Cause of Water Splitting.

Editor The Locomotive Engineer:

I notice in two or three numbers of your paper articles on water splitting, and have not seen any cause assigned for it.

I will explain it according to my idea and practical knowledge. During the late war I ran an engine on the Nashville & Chattanooga R. R., that would split water, as they call it. Sometimes she would show water in the middle gauge cock and none in the bottom or top, and then again it would be *vise versa.*

Then again she would carry tolerably good, but not as good as she ought. I complained that her dry pipe or throttle pipe was too long and too close to dome cap. The M. M. said that would not make any difference. Of course she had one of the old slide valves on top of the throttle pipe. We took up dome cap and found out she had just clearance enough to let the valve slide, so we cut it down, and gave it 2½ inches clearance. From that time out she carried water as well as any engine I ever saw with wagon top. Now perhaps those engines that are mentioned in your paper had the old Rogers throttle valve in the smoke-box, hence the dry pipe was too close to the dome cap. This trouble has never been found in my experience since the balanced throttle came out.

E. A. CAMPBELL,

Supt. M. P. & M., H. E. & W. T. and S & H. R'ys.

Houston, Tex.

A Nut to Crack.

Editor The Locomotive Engineer:

The company for which I work have two "Fairlie" engines—double engines having two fire-boxes, four cylinders, etc. In 1887 No. 1 was put in for repairs. Both fire-boxes were taken out and repaired, and the outside shell also repaired—everything being then replaced as before. But when brought out she would only run four days without priming. Formerly she ran three or four weeks all right. No. 1 did most of the work, No. 2 being used as a standby. When No. 1 was put in for temporary repairs in the following summer, No. 2 did the work, and would run four weeks without priming.

In '88 No. 2 was overhauled precisely as No. 1 had been—two new fire-boxes being put in, but on taking her out, she primed just as No. 1 had done. Water from the same well was used throughout. Can't understand it. Can you explain?

D. McLENNAN.

Lorway, Cape Breton, Can.

[A boiler with new work on it will often prime for a few days, on account of oil used on the work, but why she should prime worse after a few days we cannot see, unless some of the conditions were changed, such as more flues or flues closer together, difference in fire-box, or a change in arrangement of steam pipes.]

After "Squab."

Editor The Locomotive Engineer:

I see in the February number a rule for setting a slipped eccentric signed by Squab

To follow the rule of Squab one would have to have a blacksmith to lengthen out eccentric rods in some positions.

It is a poor rule which won't work both ways; so, according to his rule, when engine is known to be all right, taking out pin in link will not affect the link when the rod is put back to position. His idea for "some of the boys to try it and let him know how it works" is good—like the quack inventing patent medicine; when he thought up a mixture he tried it on his wife, if it didn't kill her it was all right.

If "Squab" was in earnest about his rule, he must be an engineer on a narrow gauge wheelbarrow W M ECKERMAN.

Leavenworth, Kan.

On the Proposed License Law in Illinois.

Editor The Locomotive Engineer:

The Chicago *Times* says that the bill introduced by Senator Lehman in the Illinois Legislature, making it unlawful for any person to run or attempt to run a locomotive engine in the State without having first passed an examination, and received a certificate of qualification, is not regarded with favor by railway managers. One of them said yesterday: "It is a scheme to place the railroad companies in the power of the Brotherhood of Locomotive Engineers. It requires that a man must have three consecutive years' experience as a locomotive fireman before he becomes eligible for engineer service, and must have served on the line of the company by which he is examined; also that he must have had one year's experience in the freight service before he can take a passenger train. It is simply an outrage. If it becomes a law, no company in the State will have any voice in the selection of its men, and the Brotherhood will absolutely rule that branch of the service. Suppose such a law had been in effect at the time of the Burlington strike. The company would have been tied hand and foot, and the strikers would have had it all their own way."

Mr. Editor, what is your opinion of this law? Don't you think that it is just what shippers and the traveling public have long needed? The sooner it is adopted in every State in the Union, the safer will be the lives of those whose business compels them to travel by rail. The national laws compel marine engineers to pass examinations, and prove themselves to be competent men. Why should not the locomotive engineer be compelled to do likewise? The great army of men engaged in handling the throttle are daily entrusted with thousands of dollars worth of property in addition to the lives of vast numbers of our fellow citizens. Any intelligent, thinking person will thus see the necessity of allowing none but competent and reliable men to occupy such a responsible position.

Marion, Iowa. FRED TAYLOR.

[If the law is going to provide an examination for locomotive engineers, let it also provide that no man shall be eligible for examination who has not had three or more years' experience on a locomotive as engineer or fireman—this much is right. This would insure the public against the employment of men in any emergency who had no railroad experience at all. As a general thing, the management of a road are careful in its selection of their men—it does not pay to employ grossly incompetent men—they do too much damage.

We can not see how it would be possible to enforce the law requiring that the applicant shall have served on the road for which he was examined. This would prevent the employment of experienced engineers from other roads, and would injure the order and the engineers worse than the companies.

We fail to see what good or what hurt the law would do that required a man to pull freight one year on a road before he could pull passenger—almost any man who can make time and handle air can pull passenger; he has a clear line, light trains, the best engine and the best fuel on the road—it is the men who successfully pull heavy freight trains with poor coal, green firemen and old engines, who need to be skillful. They must avoid all first-class trains, meet and overcome more varying conditions, and exercise more thought, skill and judgment, work harder, and, in fact, use more and a better class of railroad knowledge than any other men in the service.]

A Simple Relief Valve.

Editor The Locomotive Engineer:

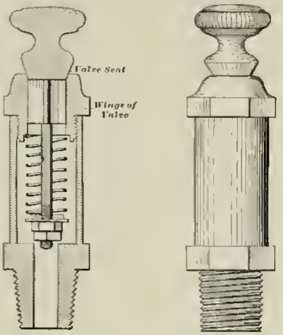
Before the steam governor for air pumps came in use, the Westinghouse folks furnished a relief valve to be attached to air pipe to prevent excessive pressure, but it did not give the best of satisfaction, so I designed and made one to suit myself, and it worked so well that I put it on all engines equipped with air brakes. I attach it to the drum-pipe just below engineer's valve. If it gets gummed up it can be loosened by taking hold of the top of the valve and turning it. I guess the sketch needs no explanation.

Syracuse, N Y. W F RELYEA.

Water Splitting Theory.

Editor The Locomotive Engineer.

The last three numbers of your valuable paper contain a vague account of *engines splitting their water*. Let us call this an emphatic kick of the boilers in question against cruel treatment. Neither your



A SIMPLE RELIEF VALVE.

three correspondents on the subject nor your readers at large make an attempt to explain so weighty a matter or guard against a repetition of same that leads to overheating, bagging and burning of crown sheets with an excuse therefore.

Supposition and mystery belong to the past. We live now in science and fact. In the name of the latter two, let me call this "water-splitting" the "spheroidal state" of water, which, by the way, is the same in the open air on a hot stove as it is in a locomotive boiler under pressure. It is a state of affairs entirely different from priming and from foaming, and may be induced in any style of boiler with any kind of water; and it can be observed. As a gauge-glass only indicates the fluctuations of water level, so we will put a circular sight-glass in boiler-head. Then raise petticoat pipe, fire hard, pull a heavy train up grade, and you will often see the condition of affairs as recorded If the sight-glass in boiler-head is objected to, a quarter-inch pipe with a cock outside can be put through shell and jacket by means of a suitable stuffing-box over crown-sheet, so it can be lowered or raised. Then, when engine is working hard, the quarter-inch pipe touching sheet, the cock open and showing water—it is there.

Houston, Tex. DE BRETON.

On Heating Feed Water.

Editor The Locomotive Engineer:

"Theory is all very fine, but when theory neglects to take into account the saving of fuel, lighter firing and better combustion that results from feeding with boiling water, theory is apt to be, as in this instance, away off

"Take, for example, the difference between feeding with water at 32 and 212 degrees. Theory will tell us that the saving will be 15½ per cent., but there is not a practical engineer in the country but knows that, aside from other advantages, the saving will be nearer 33⅓ than 15½ per cent. B"

The above matter is quoted from a paper devoted to stationary practice, and causes me to increase the confidence in Smith's heater illustrated last year. There is little doubt in my mind that Smith's report of saving of coal was correct. Many old runners in the country still contend an engine steams better with a pump, as compared with an injector. They are positive in their statements. How much better would they do with hot water? The writer has seen crossheads badly worn on side carrying pump plunger, while on other side guides and crossheads were in fine shape and little worn; an injector had been substituted for a pump and crosshead that did not carry a plunger run the longest with least wear.

With a temperature of 500° or 600° in front end, the heat radiated by same, and thus lost, would heat considerable water The boilers of Silsby fire engines do better since they bleed the exhaust and heat their feed water. A plan to heat the feed water other than taking live steam as with an injector, or unduly robbing front end, as the *Locomotive* maintains, will no doubt be hard to arrive at. However, some front ends show to the casual observer—when firemen state that they can't keep anything on them only stove polish, on account of the intense heat—they can no doubt spare enough of this heat to heat the feed water The variable exhaust nozzle or Luttgen's damper probably do this same thing in another manner. J. J Bingley advocates checking the blow-off of safety valves and turning it into the tanks to save the heat in the steam; quite proper. If an engine is steaming well, throwing cinders all over the country, burning the paint all off the front end, also blowing off, why not bleed the exhaust and put it into the feed? The heat lost by exposed front ends is no trifle; all admit it is hot air we want in fire-boxes; plenty of it can be furnished from a space around front end; same space would heat water.

A fire certainly will burn slower evaporating a given amount of water, from hot water feed, than if same amount was fed in cold, or, less fuel on the grate would be necessary, which certainly means economy. The back pressure on piston from port to nozzle grows less and less as it nears the orifice or tip of nozzle, when it, the pressure, is all merged into velocity. Steam taken from a point below nozzle and led into a heater similar to Smith's would register a pressure on the heater which means heating the water from pump to boiling point or over according to pressure. C. S C

Watertown, Wis

[If some feed-water heater were devised that uses the heat *radiated* from the front end it would probably use some heat now going to waste, but taking it out of the front end, we believe, will not pay. No one disputes that a saving would be effected by the use of a heater on an engine "blowing off, throwing cinders and working on less than her capacity", but when it comes to pulling all the cars they can, and working hard, we doubt if taking heat from the front end to heat water is not robbing Peter to pay Paul. A saving of 33⅓ per cent. by the use of a heater is beyond the range of possibility, even in stationary practice.]

H K Porter & Co., locomotive builders, Pittsburgh, Pa., have made their second annual payment of profits to employes. This year every man, no matter what his position, pay or time of service during the year, received 10 per cent. upon the wages he earned during the year If a man earned $1,000 his share of profits would be $100 This method of apportioning makes it an object to every employe to put in all the time he can. This extra money is duly appreciated, and comes in handy, and is better than wages alone—where they are the same—yet profit sharing is not the solution of the labor problem. At best it is a remedy, not a cure, a patch, not a new boiler.

Engineer Cook, who has been on trial for manslaughter for his part in the Mud Run disaster, has been acquitted.

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

Captain John Ericsson.

This venerable man, the greatest inventor of the age, died at his home in this city on March 8.

Captain Ericsson was born in Sweden, and trained as a civil engineer, having been a leveler on the great Swedish ship canal at the early age of 13. He entered the army and was detailed on engineering work and made a machine for drawing copper-plate maps that were pronounced the finest military maps then extant. He invented the flame engine in 1825, and went to London to exhibit it; here he resigned his commission and was made a Captain, in recognition of his service. He entered the competition for furnishing locomotives and built the "Novelty," to compete at the Rainhill trials in 1829, where Stephenson's "Rocket" won the prize.

The "Novelty" was defective in adhesion, but was the best built and best finished engine at the trial. Strange to say, this engine contained none of the principles now considered essential in locomotive practice; she had a vertical boiler and vertical cylinder, while the "Rocket" had cylinders in line with axle centers, a tubular, horizontal boiler and the exhaust in the stack—fundamental principles that have always been retained.

Capt. Ericsson's inventions number up in the hundreds, and some of them revolutionized the practice of the world. Perhaps his finest inventions are the engineering instruments but little heard of in connection with his name. He invented the hot air engine, much used for small power. He invented the screw-propeller, that revolutionized the commerce and the navies of the world.

He was the first to build a war vessel with all her machinery below the water line, and introduced forced blast on shipboard. In 1828 he equipped the steamship "Victory" with condensing apparatus that returned its water of condensation to the boilers. In 1829 he built the first steam fire engine—a service to mankind that can hardly be estimated. He was one of the earliest users of the link motion—some claim its inventor. The refusal of the British admiralty to use his screw propeller, declaring that "a vessel cannot be steered with the power applied to the stern," was indirectly the cause of the inventor's removal to America in 1839.

In 1841 the U. S. war ship "Princeton" was equipped with the screw, and had all her machinery below water line, and the navies of the world had to be rebuilt on her plan. His idea of a partially submerged war vessel with a revolving gun turret was offered to Napoleon in 1854, but refused as impracticable. The civil war again brought the idea up and the "Monitor," now famous in history, was built to Ericsson's plan in 1862, and sank the iron-clad "Merrimac" in Hampton Roads, turned the tide of the war, prevented foreign intervention in favor of the confederacy, and again called for a rebuilding of navies.

In 1881 the "Destroyer," a ram carrying a submerged gun 16 inch diameter and 30 feet long, shooting a projectile weighing 1,500 pounds and containing 300 pounds of high explosive, was built. This vessel Capt. Ericsson firmly believed can destroy the heaviest iron-clads afloat.

His latest great invention, the Sun engine, is already in use in Egypt and other hot countries pumping water for irrigation, etc., but was not yet perfected at the time of his death. His will provides for the carrying out of the work in hand by his associates and employes.

In the 85½ years of his life, Capt. Ericsson has given to the world more valuable inventions and done more for mankind than any other inventor the world has ever seen.

In his research he has never been very badly hampered for money, and has been able to carry out his ideas and demonstrate their value. He built and equipped the "Destroyer" at his own expense.

He was an admirable draftsman, and proved all his theories by correct mechanical drawings. He lived frugally, took a certain amount of nourishment, sleep and exercise, and worked steadily up to within two or three days of his death.

The immediate cause of his death was affection of the kidneys, combined with a general exhaustion of nature.

It is announced that the Reading are buying a number of locomotives with the Wootten fire box.

An Unjust Accusation.

Some of the western papers or their correspondents are trying to curry favor with the Knights of Labor by denouncing Geo. W. Cushing, lately appointed Sup't. Machinery of the Union Pacific, as an enemy of labor organizations, and characterize his appointment of a prominent knight as his private secretary as a bid for favors and a scheme to "pacify" the knights. The editor of this paper happens to know Mr. Cushing and his position on the labor organization question. Being a friend, a believer in, and a member of labor organizations, we can only wish that organized labor had no worse enemies than Geo. W. Cushing.

Occupying the positions he has in the past and does at present, it cannot be expected that he will advertise as a believer in the employment of men because of their affiliation with some labor organization—he has to accomplish results with men selected for their ability in their profession—and we believe he will in the future—as he has in the past—judge men by their work, not by their membership here or there. Mr. Cushing's time on the P. & R. was brief, and if the truth were known, the straw that broke the camel's back and brought about his resignation was the order to select men for his department who did not belong to labor organizations.

Years ago Mr. Cushing remarked that labor organizations did cause some trouble, *but not as much as individuals did before their organization.* To the men in the motive power department of the U. P. we would say, do your duty, be temperate, ask for what is right and do not ask for what is unreasonable, and rest assured that Geo. W. Cushing will never question you about what you do or do not belong to. Mr. Cushing used to be a locomotive engineer, and knows how it is himself.

Selecting Good Material for Good Work.

We take the liberty of publishing part of a private letter from Clinton B. Conger, engineer of the State Railway Commission of Michigan, on the subject of promoting firemen. Mr. Conger is a practical locomotive engineer, one who stands high in his profession and who has the best interests of the men in it at heart.

The subject of the selection of engineers, however, covers a good deal of ground, so that I could make another chapter or two out of it and still not step off the edge. If the next set of engineers are to keep up with the requirements of the business, none but the most capable and intelligent young men must be employed. They must be young men of strong body, strong mind, with courage that open switches or bulldozing officials can't shake, cool and clear headed in presence of the dangers that beset them every trip, and minds that will detect the real values or faults of the different devices that are crowded on them every day to test, must be sober and temperate both in speech and habits, and above all *tell the truth every time*, if they know it. I have no earthly use for a man on an engine who can't or won't do that. Maybe my standard is pretty high, but I tell you the business is "way up," and climbing higher every day, and I am proud of it.

I am glad to see your paper taking the stand it does, and will help you all I can till I run out of ideas that are not old or are better expressed by some one else.

Like the Insanity Dodge.

Every broken-down bridge in the country is laid at the door of broken axles and wheels. Curious thing that we so seldom hear of broken axles and wheels, except when a rotten old toothpick bridge breaks down. In the past ten years 50,000 and 60,000 pound locomotives have been replaced by others weighing upward of 100,000. Cars have more than doubled in capacity and weight, speeds have advanced from an average of 20 to nearer 40 miles per hour, and trains have multiplied like rabbits in Australia, but the same old bridges are considered good enough—passengers don't see them—and they stand the racket till a broken axle paralyzes them.

These bridge disasters are coming thick and fast, and a few wholesome verdicts by coroners' juries would do much to get them propped up or replaced by modern ones adapted to the service.

Our Torpedo Signals.

While we doubt the safety of depending on men's ability to tell on which rail a torpedo is exploded, our correspondent, "Vulcan," touches a timely topic, in our last issue, on the abuse of the torpedo system.

On a recent western trip we talked with several engineers on a road where trainmen are provided with a device for putting out torpedoes from a running train. They abuse the safeguard placed in their hands, and commence to drop torpedoes as soon as they get a little behind, or during a fog; one passenger engineer said he ran over something like 16 the night before in a distance of 13 miles, all placed by one train. A stop for all these, or even a slow-down, would have seriously delayed a first-class train for a train that had no right on the time of the passenger.

A torpedo, like a red flag, should be used only as a danger signal, and should mean "stop," and a flagman should be there to explain the cause of the danger signal's display.

The Caution Signal.

In all countries and on all roads where they have a safe and entirely successful signal system there will be found no "caution" or "slow" signals. It is either go or stop. The failure to give entire satisfaction of block signal systems in America has been, we believe, the persistence with which we stick to the caution signal. This device placed in the hands of the signal man is a sort of ease-off for his conscience if he is taking chances and keeps important trains from making time. The rules of the road and the education of the engineers tell all the points where caution or reduced speed is necessary. If a block is not clear it is not safe to go, and if it is clear, the white signal is the one.

The Old Colony have tried a device for automatically opening a cock in the train pipe and setting the brakes, regardless of the engineer. The device is simply an incline rod near the track that strikes the handle of a valve. It is attached to a switch or signal lever for operation, and there is also a wooden block for the same purpose, to be carried by track men and put out instead of torpedoes. The cock is located on right side of pilot, and after the brake is set by it, it can only be released after closing the cock by hand.

The Pennsylvania has issued an order that the conductors and engineers must read train orders, while operator reads office copy aloud; the engineer must show his copy to the fireman and the head brakeman, and the conductor to rear man. This is business. Orders should be understood by every man on the train. It is an element of safety.

Have your paper addressed to a box number or a street. We have considerable complaint about missed papers and almost always find them addressed to some shop or roundhouse. Every care is taken in this office to get the address correct and plain. The Locomotive Engineer is too popular to keep long in a roundhouse mail box.

Devices for burning petroleum under boilers are now reasonably perfect, and could be used successfully on locomotives; the reason that it is not adopted and will not be adopted, is that petroleum fuel is more expensive than coal. In Russia, where crude oil is a drug on the market, it is used with fair success.

The next meeting of the M. M's Association will discuss papers on three very interesting subjects, to wit.: Best Proportion of Flue and Grate Area in Locomotives, Driving Brakes, and Best Boiler Covering to Prevent Radiation.

The railroad commissioners of several States have taken up the subject of couplers, and propose to try and stop some of the killing and maiming now done by the link-pin-and-deadwood guillotine. Success to them.

ASKED & ANSWERED.

(13) J. B. B., Chatham, S. C., asks:

What is the rule for determining proper length of link? *A.*—There is no rule. Average length for standard 8-wheeler, 11 to 16 inches

(14) I E. H, Escanaba, Mich., asks:

Is there any law against minors running locomotives? *A.*—In some States there are laws against the employment of minors on railways without consent of parents, but we know of no law against their promotion.

(15) W. T. W., Brooklyn, asks:

What is the best preparation for putting on extension fronts and stacks to keep them black and sleek? *A.*—Boiled oil darkened with a little lampblack is most generally used There are heavier paint preparations that are sometimes used, but they generally scale and make a bad looking front and stack, and cause the fireman unnecessary work in cleaning them

(16) C. F. D., Tracy, Minn., asks:

Do you know of any patent cup or device for oiling engine trucks through the box? If so, can you send me drawing? *A.*—A common kind of cup for this purpose is made of sheet metal with a wick feeder. We believe the N. P road use the McNaughton and Beardsly cup for this purpose (illustrated in our Nov. '88 issue).

IN THE ROUNDHOUSE AND Repair Shop.

Items Picked up in the Altoona Shops.

On a recent visit to the shops of the Pennsylvania Railway at Altoona, the philosopher noticed several things out of the usual run. The P. R. R. owns 1,320 locomotives for its own line, and something like 3,000 when you include its controlled lines, and, as Altoona is the principal shop, most of the building and rebuilding is done here.

The locomotives are all built to a standard size for each class, and this systematizes matters considerable.

In the erecting we noticed that there was a large sheet metal pipe temporarily fastened onto the exhaust nozzles, extending out in front of engine some ten feet and then down to sewer, by using this, they can blow out an engine and test all joints of steam pipes, etc., without filling the shop with steam, and before the front end is closed up, the cylinders or chests cased or the boiler lagged.

In this shop most of the work is done on the piece-work system, but the work is so systematized that it is much easier for the men and the foremen. The system is fully explained in another article.

In the blacksmith shop they are using very successfully a new gas-making device of very simple design, something on the plan of water gas retort, in which they inject a jet of steam under the coal in the retort and pass the products of combustion through heated flues of fire-brick. The affair is said to be simple and easily handled, makes an intensely hot fire free from sulphur, and does not scale the iron. In this shop much of the standard work for locomotives and cars is made in dies and kept in stock, such pieces as the ends of arch braces, link hangers, eccentric fork ends, etc, being formed at a single blow under the steam hammer. In the erecting shop there is a very ingenious portable milling machine for slotting out all the port holes in cylinder casting at one operation, and always to a standard width of port and bridge. This little machine is held in place by the four corner steam chest studs, and is driven by a rawhide rope with compensating weights, that allows it to be run in any position anywhere within a floor space of ten feet from the driving pulley It is the invention of Mr. Jos. Davis, assistant to M M Strattan. Since the introduction of metallic packing the road has had some trouble with leaky stuffing-boxes, the casting on steam chest was found to leak regularly and to cut out badly by use of tallow. This trouble has been obviated by bushing the box with brass in new as well as old chests and cylinder heads.

The car shops here are very complete, and use machinery for more purposes than usual in such shops. They use bulldozers and formers for most of the iron work in trucks and frame, and have in use a very ingenious machine for making car links. The weld is formed on the side of link, a great number have been broken in the testing machine, that show that the weld is the strongest part of link. The man operating the machine gets one cent each for links, and makes 500 per day.

This shop is building a very handsome dining car, finished internally in white and gold.

Although the Altoona shops are the largest in the country they are building an entire new plant, complete in itself, for the manufacture of locomotives, with a capacity of 150 per year; this, it is hoped, will relieve the pressure on the repair shops.

A committee of master mechanics and other officials of the road are now looking up the matter of equipment, and expect to put into the new shops only the most modern tools. There are several roundhouses, very large, furnished with steam turn tables, steam boiler washing and testing apparatus, telescoping smoke-jacks, etc.

A few years ago this road put on a great number of steam reverse gears, but since the introduction of successful balanced valves they are taking them off.

Pedrick & Ayer, builders of special tools for railway repair shops, Philadelphia, are building a new shop near their present quarters. The building is of brick and stone, 40x160, two stories (with provision for a third) and a basement under part of the building. The new shops will have a boiler and engine room, casting storage room, elevators, swinging cranes, over-head tracks and trolleys, and all modern improvements, the heavier tools steam hammer, etc., having special foundations built for them. It is a pleasure to record this evidence of prosperity, for these gentlemen are practical mechanics who took hold of a special line of railroad work, and by doing good work, advertising intelligently, using judgment and employing brains and ability, and keeping abreast, if not a little ahead of the demands of the trade, have built up a reputation and a business they may well be proud of. Hope the new shop will be too small.

Some of the daily papers, in speaking of the recent tests of steam-car heaters on the P. R. R., said

"The practical advantages in this system are its simplicity of construction and thorough safety, and secondarily, *its economy, the only expense attached to it being the first cost of placing the apparatus in the cars.*"

Now here is the future successful car heater, or any other kind of a heater. After it is once in the car no expense for fuel to produce heat. We will give one year of our life—and cut it off right now—if the owners of this patent will place one in the basement of our house beside the hungriest and coldest furnace that ever smiled and smiled and was a villain still.

At the Renovo shop of the Penna road they use a Rieppel drill for drilling and reaming all holes for bolts holding front end to cylinder saddles. This simple drill frame is clamped to the front end sheets and centered when—without further adjustment—it can be made to drill and ream every hole, always true and from a common center. After cylinders are placed under the boiler a machinist and helper adjust the drill, and drill and ream all holes in about four hours. We believe if this tool was better understood it would be used by our master mechanics and pay for itself every year in the quantity and quality of work done.

One of the three great oil refineries at Franklin, Pa, recently made an estimate, showing that, out of about 55,000 miles of railroads situated west of Chicago, St. Louis, and St Paul, their product, "Galena" coach, car and engine oil, is used upon nearly 50,000 miles, the remainder being kept slick by local dealers.

A little inquiry into the many cases of locomotive boiler explosions—crown sheet affairs, most of them—go to show that some of our big roads are as prone to use boilers 20 years old as enginemen are to lose sight of their water level—the usual verdict in all such cases.

Sensible Locomotive Builders.

We are in receipt of the advance sheets of H. K Porter & Co.'s new catalogue for 1889. This firm build light locomotives for a hundred purposes, and the new catalogue contains a working report from the owners of some 500 of their engines in all kinds of service and in every section from the equator to the Arctic circle.

The book contains about 150 pages, and has a great many rules for finding grades, curves, weights of rails, and a hundred other things of interest to enginemen; it is given away to interested parties, and would be a valuable addition to any engineer's or fireman's library.

These builders have had experience with all kinds of enginemen, and the following shows their ideas of what is needed in this line:

"We wish to urge upon capitalists and organizers of new motor lines the necessity of having not only good motors, good cars and good track, but also of having some competent, experienced railroad man, who will know how to keep everything in running order. The lack of such a man may mean failure, and is sure to involve a loss of more money than his salary would amount to. On small roads, running but one or two motors, he may also serve as engineer On motor roads the service is always severe, mud, dust, sharp curves, uneven grades, and constant stopping and starting demand good care of machinery; small engines on short runs with frequent stops are expected to make a greater mileage than is made by large locomotives on long roads. It is very short-sighted policy for a motor road, after demanding and getting the very handsomest and most efficient machinery, with all the latest improved appliances, to let their motors and cars lie out in the weather without protection or care. It is a very costly economy to hire the cheapest engineers, or to let the track get out of line and sunk into the mud, or to jump trains over rails at crossings."

Careful Engineers.

In a recent letter to Mayor Grant, of New York, Jay Gould makes this remarkable statement:

"Up to the 1st of January, 1889, the lines operated by the Manhattan Company have transported 1,069,487,620 passengers, of whom but one has been killed while in the cars, and those who have lost their lives upon the structures of the company are but 47 in all, not one of whom, the officials of the company claim, was free from some act of negligence which directly contributed to the fatal result."

Touch and Go.

The *Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Co., states that there were 246 boiler explosions in the United States in 1888; number of persons killed outright, 331, number injured, 505—fully 100 of them fatally. This is a total of 836 killed and maimed during the year, this does not include the many minor accidents not reported.

A First-Class Stack for Less than Ten Dollars.

As neat straight stacks as are to be seen on the Richmond & Danville are hard to find. They are made of cast-iron of neat design and symmetrical outlines, as shown by our engraving; the stack shown is the second of three sizes, and is the one used on the 18 x24' cylinders; it is 36' in height; 13' at the smallest, and 20' at the largest opening, weighs 390 pounds; the saddle weighs 85 pounds.

These stacks are made by using a green sand core, swept up on a cast core arbor.

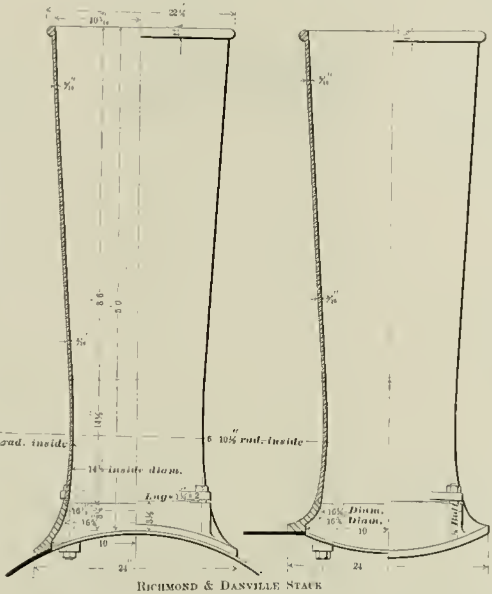
They are cast, cleaned, the bottom joint turned, lugs drilled, and sent to the storehouse, complete, with bolts, for $9.25; with saddle, complete, ready for smoke arch, for $11.

Any iron will do for stacks, if the bottom is soft enough to admit of turning—indeed, at the Manchester shops they are made of old brake shoes.

In addition to being neat and cheap, they prevent expensive repairs in accidents. A common, wrought stack, with a heavy base, is strong enough to bend or break the sheets of the front in case of rear collision, etc., while the cast stack breaks off at the weakest point—the neck—seldom disturbing the base.

A first-class wrought stack, with cast base and Russia jacket, costs upward of $50, and is inferior to the cast stack in every way. With cast stacks there is no waste metal; when broken or worn out they are so much metal for the cupola.

The automatic torpedo placer is a very simple and efficient attachment that places a torpedo by the movement of a signal rod or switch lever, and are being placed on a good many roads. They are a great protection in fog.



Richmond & Danville Stack

A Grand Record.

An English paper gives a life sketch of Mr. Robert Billingham, a locomotive engineer on the Great Northern Railway, and says: "Mr. Billingham commenced railroading in the year 1838, and has been in active service from that period to the present, over half a century. During some of the revolutionary wars of France he was engaged in that country as a locomotive engineer, and many and various were the hair-breadth escapes which he encountered from bridges being burned and the track torn up by the opposing forces. After the wars of the revolution ceased, he returned to his native country and commenced running for the Great Northern Railway Company, in whose employ he has remained until recently, when, owing to ill health, he was obliged to retire from the service. During the whole of his career he has not had one single accident of a serious nature, but he has prevented several. Once, while standing in front of a station with his train, he saw another train ahead coming down the track at a terrific rate of speed. With great presence of mind he backed his train out of the way of the other, just in time to prevent an accident, which must have resulted with the loss of a number of lives.' Mr. Billingham has two sons in the railroad service of the United States, one being employed in the capacity of traveling engineer on the lines of the C., M & St. P. Railway, west of the Mississippi river.

Since our illustration in January issue of the Weaver spark-arrester, Gen. Supt. F. M Baker, of the Addison & Pennsylvania R. R., Addison, N Y, is putting one on a locomotive for trial on his road. As Mr. Weaver, who is M. M of the Lehigh Valley at Sayre, Pa., has used the device successfully on 140 locomotives burning both hard and soft coal, Mr. Baker's experiment is not a very risky one.

Watson & Stillman, of this city, are getting out patterns for a small size of Vreeland's Transfer Jacks designed especially for removing the intermediate pair of wheels in 6-wheeled trucks. The present method of jacking car body off the truck and then the truck above the central pair of wheels is expensive and takes time.

The McConway & Torley Co., of Pittsburgh, have placed on the market a new rail joint that has some novel features. It consists of angle splice bars to maintain the line, and a heavy clamp that wedges the lower flanges and plates firmly together by a heavy bolt. This secures surface, and prevents the action of the wheels from battering the end of the joints. In an 18 months' trial, in which 17,048,440 wheels passed over the joints, they remained intact, with but one tightening and one surfacing of track.

All the new consolidation engines on the P. R. R have the Belpaire fire-box, but we notice that the corners of wagon top are turned on a larger radius than usual; they have a little trouble with broken stays, a complaint we have not heard of from this class of boilers in other quarters.

Last winter the Richmond & Danville folks made an experiment with metallic packing on the slip coupling on Martin steam heater. The fibrous packing at each end of the cars soon burns out and leaks; the metallic packed joint was put on rear of a tender, and has run till now without attention and without leaks.

Rebuilding Locomotives on a Time Schedule.

In all railroad repair shops great delay of work is often caused by the neglecting or forgetting of some piece of work, for which a locomotive is obliged to wait one day or more.

It is very hard for foremen and gang bosses to so arrange their work and place their men as to avoid getting one class of work in the way of some other class, or of men employed on one job from having to wait for another before they can proceed with theirs.

At the Altoona shops of the P. R. R. great trouble was experienced in this way until Jos. Davis, Assistant M M., conceived the idea of running the engines through the shop as they were run on the road—on time.

As most of the work at Altoona is done on the piece-work system, and all of it is done by special gangs of men for each class of work in separate shops, Mr. Davis arranged a general time card for the erecting shop, that provided for the stripping of the engine, and the distribution of the parts to the different shops, and also for such work as was necessary on the parts not removed from the erecting room.

When a locomotive comes in, a clerk makes out the following time card for the erecting shop:

PENNSYLVANIA RAILROAD COMPANY

GENERAL REPAIRS TO ENGINES.

ERECTING SHOP.

.....Division Engine No......Class..... ...
Repaired by................ .. ..
Class of Repairs.............

Taken in Erecting Shop	Sent to Boiler Shop.	Out of Boiler Shop.	Out of Erecting Shop	Sent to Paint Shop	Out of Paint Shop.	Ready for Service.

DAY	OPERATION.
1st.	Stripping Engine.
2nd.	Cleaning and Distributing Machinery
"	Steam Pipes taken out.
"	Renewing Bolts in Frames.
3rd.	Facing Pedestals.
"	Refitting Pedestal Caps.
"	Facing Cylinder Joints.
"	Smoke Stack base and Headlight bracket fitted on Boiler.
4th.	Re-boring Cylinders.
"	Back Cylinder Heads put up.
"	Fitting and laying out Shoes and Wedges.
5th.	New Cylinders fitted to Boiler.
6th.	Crosshead Guides set.
"	Valve Seats Faced
8th.	Hopper fitted to Smoke-box extension.
"	Injectors put up.
9th.	Driving Boxes fitted.
"	Sand-box Finished and fitted on Boiler.
"	Smoke-box Extension finished and put up.
10th.	Driving Springs and Rigging put in place.
"	Truck Repaired.
11th.	Truck and Driving Wheels in place.
12th.	Steam Pipes put in and Dome closed.
"	Pilot put up and Braces attached.
13th.	Valves set and Eccentrics keyed on.
14th.	Boiler Front and Door put up.
16th.	Main and Truck Wheel Covers put up.
17th.	Ash Pan, Drop Grate and Damper finished
"	Number Plate and Side Badges put up.
18th.	Engine to go on trial.

This time card the foreman follows, and on the second day the parts are distributed to the different shops. The clerk also sends to each shop foreman the following time cards, the top of cards giving dates work must be out of each shop, being the same on all.

BOILER SHOP.

2nd.	Boiler and Fire-box examined.
5th.	Smoke-Box Extension finished
8th.	Boiler repaired.
9th.	House Irons fitted to Boiler and Cab.
10th.	Cistern repaired and sent to Cab shop.
11th.	Air Reservoir tested.
12th.	Fire Door Repaired and put up.
13th.	Boiler tested.
14th.	Ash Pan repaired and put up.
15th.	Apron repaired and put up.

FLUE SHOP.

3rd.	Flues taken out.
4th.	" cleaned.
5th.	" scarfed and welded.
6th.	" brazed and annealed.
7th.	" marked, cut off and opened.
8th.	" put in boiler last time.
11th.	" caulked and water grates put in.
"	Arch Pipes put in.
16th.	Engine piped.

LATHE SHOP.

3rd.	Facing Cylinder-head Joints.
4th.	Sand-box Base finished.
"	Driver Brake Pads planed and slotted
"	Driver Brake Hangers drilled.
"	Shoes and Wedges planed.
"	Crosshead Guides planed.
5th.	Crosshead Gibs planed.
"	Cam Screws turned and Crossheads slotted.
"	Lift-shaft Bearings bushed
"	Driver Brake, Cylinders, Pads and Braces drilled.
"	Rocker Bearings planed and bored out.
"	Shells in Driving Boxes and Boxes planed.
"	Pistons and Followers trued up.
"	Crossheads and Shoes planed.
"	Pump Plunger trued up.
"	Valve Rods and Link Pins turned.
"	Reverse Lever and Reach-rod Pins turned.
6th.	Steam Chests, Lids and Casings faced.
"	Guide Blocks and Bolts finished.
"	Truck Boxes bored out.
7th.	Driving Boxes bored out.
"	Main Valves planed.
"	Stems of Valve Yoke trued up.
"	Rod Brasses planed.
"	Valve Yoke Glands bushed.
"	Steam Whistle repaired.
8th.	Pump Gland bushed.
"	Piston Gland bushed.
9th.	Steam and Water Cocks repaired.
"	Sand Box and Gearing repaired.
10th.	Bell Bearings repaired.
13th.	Boiler Front and Door finished.

VISE SHOP

3rd.	Machinery examined and distributed.
4th.	Valve Yokes refitted to valves.
5th.	Crosshead Guides trued up.
"	Crosshead Shoes lined.
6th.	Guide Yoke repaired.
"	Rockers refitted to bearings.
"	Lift-shaft Bearings and Reach-rod Jaw fitted to shaft.
"	Eccentric Straps refitted to Eccentrics.
7th.	Valve Rods repaired.
"	Injector repaired.
8th.	Pump repaired.
"	Boiler Check repaired.
"	Throttle Lever repaired.
"	Relief Lever repaired.
"	Crossheads repaired
"	New Lever fit to Whistle.
9th.	Piston repaired.
"	Reverse Lever and Quadrant repaired
10th.	Dome Cap repaired.
11th.	Links repaired and put upon Engine.
12th.	Main Rods repaired and put on Engine.
15th.	Main and Truck Wheel Covers finished.
17th.	Main and Side Rods repaired and put up on Engine.

SMITH SHOP.

2nd	Closing Pedestal Caps.
3rd.	Driver Brake Pads, Links and Cam Screws forged.
"	Driver Brake Hangers, Crossheads and Braces forged.
"	New Stems welded to Valve Yoke and fitted to Valve.
6th.	Draft Iron repaired.
"	Driver and Truck springs reset and tested.
7th.	Equalizing Beams, Posts, Links and Gibs repaired.
"	Main Frames and Braces welded when broken.
8th.	Tender Irons repaired.
9th.	Pilot repaired.
10th.	Damper Rigging repaired.
12th.	Pilot Braces adjusted.

WHEEL SHOP.

6th.	Smoke-box Extension faced.
7th.	Tires turned, Journals trued, and Pins renewed.
"	Truck and Tender Wheels finished.

TIN SHOP.

6th.	Jacket put on Cylinders.
7th.	House Irons fitted
11th.	Spring covers repaired and put up (Pass engine).
13th.	Injector Pipes finished
14th.	Main and Truck Wheel Covers finished.
"	Bridge Pipe cased.
15th.	Jacket put on Boiler.
"	Jacket put on Driver Brake Cylinders.
16th.	Air Brake Pipes finished.
"	Three Way Cock Pipes put up.
"	Lift Pipe and Netting fitted in Smoke-box
"	Dome Casing fitted on Engine.
17th.	Smoke Stack finished and bolted on Boiler.

AIR BRAKE SHOP.

8th.	Air and Steam Gauge repaired and tested.
10th.	Driver Brake Pads and Cylinders repaired and put up.
15th.	Auxiliary Reservoir repaired and put up.
"	Driver Brake Clogs and Cams repaired and put up.
16th.	Three-way cock put up.
"	Air Pump and Main Reservoir repaired and put up.
"	Air Brake Pipes clamped

CAB SHOP.

2nd.	Tender stripped and made ready for Boiler Shop.
6th.	Lagging put on Cylinders and Wood underneath (Pass. engine).
"	Bumper put on when new
8th	Foot boards and Cab put up.
"	Floor laid and Step put up (Pass. engine).
9th	Pilot repaired (Pass. engine).
12th.	Pilot set up
"	Tender finished and sent to Paint Shop.
14th.	Lagging put on Boiler.
15th	Running Boards put up.
"	Head-light Board put up.
"	Moulding put on underneath Wheel Covers.
"	Lagging put on Dome.
32nd.	Seats, Boxes and Sash put in Cab.

PAINT SHOP.

22nd.	Engine received in Paint Shop.
32nd.	Engine out of Paint Shop.

ON TRIAL.

19th	Engine made ready for trial.
20th	Engine on trial.
22nd.	Engine tried and sent to Paint Shop.
33rd.	Engine ready for service

We do not doubt that many master mechanics and shop foremen will be able to pick up valuable hints on the proper time to have work done, in order not to interfere with other work, and we give the time cards complete, as it is the first systematic plan for rebuilding on time that we have seen.

The Locomotive in America.

By WILLIAM BARNET LE VAN.

FOURTH PAPER.

In all American standard locomotives the outside connections are universally adopted. The cylinders are placed nearly or quite level—truck wheels being spread to about 4 feet 10 inches between centers, to give the required room, as well as to secure steadiness in running. The framing is forged solid with pedestals welded on. The springs of the driving wheels are always connected by equalizing levers, excepting in six-wheel combined locomotives, where one pair of springs are sometimes independent. The shifting link-motion is almost entirely used—the steam slide valves being on the upper sides of the cylinders, and worked through the intervention of a rocker-shaft. The pumps are, in the majority of cases, "full-stroke," being worked directly from the cross-heads. Air chambers and suction chambers are always provided to secure a steadier flow of water and to ease the strain on the pumps. Of late years all locomotives are fitted also with injectors. The crosshead and guide-bars are almost universally of one pattern. The regulator or throttle is almost always in the smoke-box. The house or cab, the pilot or "cow-catcher," the bell, and the spark arrester are appendages which belong exclusively to the American locomotive. The boiler is the usual form known as "wagon-top." In size, while the boiler and cylinder are varied to suit the work, the wheels are less variable in diameter. Five feet is a common size of driving wheels for all classes of work, although five and one-half and six feet are used to some extent for passengers. Freight locomotives with six and eight coupled wheels have drivers of from forty-three to fifty-six inches diameter, two railroads, the Baltimore & Ohio, and the Reading, have a large number with wheels of forty-three inches diameter.

On American roads of ordinary grades and traffic, the principal difference between the passenger and the freight locomotives is a difference of six inches in the size of the driving wheels, and an excess of from ⅛ to ¼ inch of inside lap in the valves of the freight locomotives.

The experience which has determined the standard plan of American locomotives may be stated as follows: As compared with English railroads, the loads moved are heavy and the permanent way is weak, so too the grades or inclines are long and steep, and the curves numerous and sharp. Hence the greatest power must be exerted with the least injury to the track. Thus, instead of a single pair of driving wheels, as formerly used in England, bearing one-half the weight of the locomotive, two or more pairs of coupled driving wheels are invariably used, taking two-thirds of the whole weight, with *thirty-three per cent.* less weight on a single point of bearing on the rail. Thus a twenty-four ton American locomotive has, say sixteen tons adhesive weight, with but four tons on any one driving wheel.

The office of the forward truck is apparent, in turning curves of short radii—often of 200 feet, while 650 feet is a very ordinary radius. The truck also, by its four wheels, distributes the weight of the forward end of the locomotive, and as its support is at or forward of the center of the smoke-box, it throws more of the weight of the locomotive upon the drivers than would a pair of leading wheels placed behind the smoke box. To reduce the friction of swiveling, and to take the weight equally on each truck wheel, the truck frame generally carries its load on its center. To secure the full power of the engines when required, the valves have moderately short lap on the steam side—seldom over ⅛ inch at each end, and generally but 1/16 inch for a valve of five inch maximum throw. Thus the admission can be made equal to ninety per cent. of the full stroke, while very few engines are arranged for as little as thirty per cent. admission, thirty-five per cent. being the more usual minimum.

All American locomotives are outside connected, from the fact that they are more *get-at-able*. There is no peculiarity in the adaptation of the locomotive to wood burning, as compared with that for coal burning, except that in the first case the grate bars are of cast-iron and in the second they are generally formed of tubes through which a constant circulation of water is maintained, and that the blast pipes are smaller. The proportions of the boilers are the same as are employed in England with the exception of the grate surface, which is larger, due to the use of anthracite coal in the place of coke and bituminous coal; but American boilers are built of thin iron in the fire-boxes, or of ¼ to 5/16 inch steel instead of copper; the tubes are almost always of iron, as they are found to remain tight better than brass under all the contingencies of rough setting and hard work.

A considerable advantage is found in the equalizing levers between the springs, especially on rough roads.

Full stroke pumps are used with air vessels on both the suction sides. They fill surely and work easily, as to the pipes and joints. Each locomotive is fitted with an "Injector" as an auxiliary in case of failure or damage to force pump, and in recent practice injectors are employed to the exclusion of pumps. To employ still more of the adhesion, and to distribute still more weight on the rails, locomotives with six and eight coupled driving wheels have been much employed. For very heavy traffic, like that of coals, and on very severe grades or inclines, the "Consolidation" locomotives, having eight driving wheels coupled and a "pony truck," has obtained the preference over the "ten-wheeled" locomotive formerly used. The "Consolidation" plan is preferred for locomotives of about 100,000 pounds' weight—88,000 being on the drivers, of which 11,000 pounds only are on each wheel. Practically, there is a little variation of the weight distributed respectively by the separate pairs of wheels, but no more than is due to the difference in weight of counterbalances and other attached parts in the wheels themselves. For lines of sharp curvature this type of locomotive is built with two pairs of flanged driving wheels, either the front or rear or the main and rear pairs.

The other two pairs of coupled wheels have tires without flanges. The pony truck has a swing bolster and radius bar. The total wheel base of locomotives with eight-wheeled tender is 47 feet 10 inches. At the present time, 1889, the Baldwin Locomotive Works are building a new style of locomotive, the "Decapod" type, for extreme mountain grades, having ten coupled driving wheels and a pony truck. The arrangement of flanged and plain driving wheels will permit of broad gauge locomotives of this type traversing curves of 330 feet radius. From all the experience upon American railroads, locomotives without trucks are considered to strain the track.

On some of the older engines on the Petersburg Railway (Atlantic Coast line) there is a cast-iron box on each running board, just over the guides, to hold the signal lamps.

It is said that Master Mechanic John Campbell, of the Lehigh Valley, at Delano, Pa., will build the largest 8-wheeled passenger locomotive yet constructed in this country.

Locomotive building is dull now—a very good time for the different works to put in new tools and make needed repairs. It is also a good time for roads in need of power to get bids.

One of the handsomest catalogues of the season is the 200 page bound book sent out by Hilles & Jones, Wilmington, Del. This firm make a specialty of tools for boiler and bridge work. Some of their tools have reduced the first cost of locomotive boilers one-third.

A Hogisher Hog.

The humorist and the soberist and all the other ists that push newspaper pencils, have had their jab at the railroad hog who is always pictured as a low-browed villain with a penitentiary scowl, two whole seats and part of the aisle. On recent excursions among our constituency, the philosopher has observed that there is another and a worse railroad hog that wears skirts, Langtry bangs and earrings. She holds forth in the sleeper, and she arises betimes, and, locking herself in the ladies' wash room, gets both feet into the trough and stays two hours.

There is more than one kind of hog—for instance the men who will run their engines 22 hours a day and make $297.38 for a month and let an honest man on the extra list starve.

The Fitchburg Railroad Company, through superintendent John Adams, has presented a gold watch to engineer Edwin Warren, "for meritorious conduct at Gardner, Mass., Jan. 11, 1889." Mr Warren is the engineer who was on that day in charge of an inward bound express train at 10 P. M., going at the rate of 30 miles an hour near Gardner, when he saw several cars of a broken freight train backing down the steep grade on the same track toward his engine. By reversing his engine and gradually backing he caught and stopped the freight and avoided a serious accident. A letter was presented to him also from President Phillips, couched in words of commendation.—*Ex.*

Even the P. R. R. get behind the times in shop practice—we noticed several old Sellers & Bancroft lathes of the 1854 patent running in the Altoona shop.

We understand there are two Strong locomotives in course of construction for the A., T. & S. F., at the Schenectady Locomotive Works.

GEO. WESTINGHOUSE, JR., PRESIDENT. T. W. WELSH, SUPT. JOHN CALDWELL, TREASURER. W. W. CARD, SECRETARY. H. H. WESTINGHOUSE, GENERAL MANAGER.

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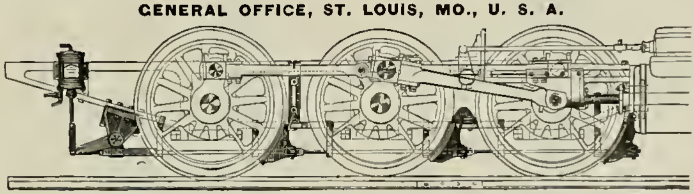

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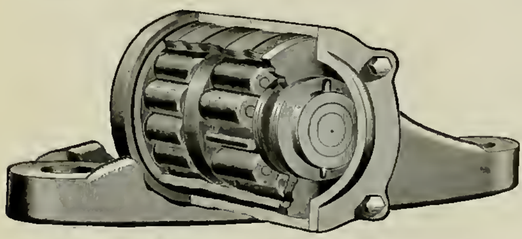

This bearing is constructed on an entirely new principle, by which the axes of the rolls are always kept in line with the axis of the shaft. The journal boxes are absolutely dust-proof, and we guarantee that one lubrication will answer for one year's constant service. By recent tests with the dynamometer upon the tracks of the West End St. R'y. of this city we have demonstrated a saving in power over the ordinary journals of from 30 to 70 per cent. We are prepared to furnish these bearings for trial, and invite correspondence.

For prices, terms and additional information apply to

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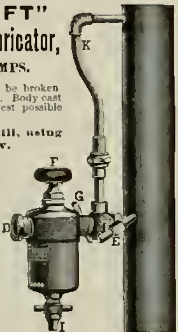

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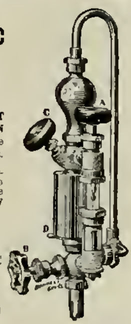

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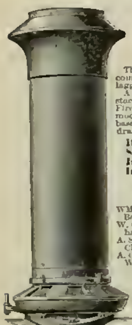

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It effects a reduction in the coal bill.
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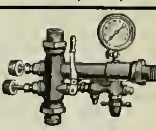

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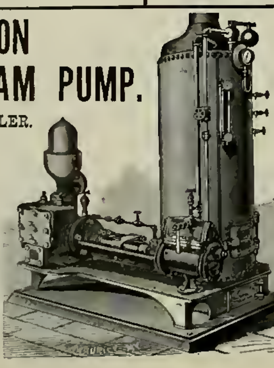

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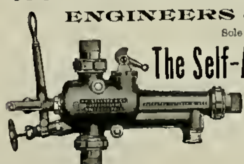

Range of Capacity over 60 per cent., and can be regulated, therefore, to work continuously for light or heavy trains. Never fails to promptly lift hot or cold water.

No service on a locomotive sufficiently severe to permanently stop its working.

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THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. V. NEW YORK, MAY, 1889. $1.00 per Year, or 10c. a copy.

'Cording to the Pay.

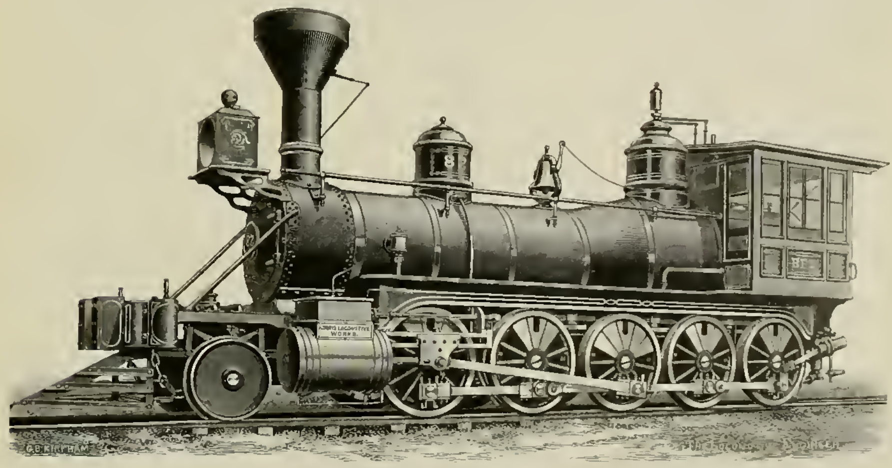
"Johnnie," said the old machinist, as he used the back of his hand to wipe a little sweat off and a little grease upon his manly brow, "Johnnie, you are in your second year as 'prentice now, ain't you? Well, when you went from 75 cents up to $1.10 a day you ought to shove your hand out a leetle furder on that hammer helve; yes, 'bout there. Next year you'll be gettin' $2.15, then shove her out perty nigh the end, and when you get a real live jour's pay, $3, why, git clean out—lap your little finger over the end and hit hard. Work your leverage 'cording to your pay, Johnnie, 'cording to your pay. You're younger nor me, Johnnie; git down in that pit, and git my cape chisel, that's it, boy, that's it; you are going to make a first-class machinist some day, sure as you live."

Long Runs for Locomotives.

The Strong engine is getting a large dose of cheap advertising on account of a run or two on a slow day express over the Erie, between Jersey City and Buffalo, 423 miles, the claim being made that she takes the place of four engines. To be sure, running one engine over the four divisions does not require four engines, neither do all three of the regular engines lay still while the fourth is at work. There is many an engine in the country, getting "chain-ganged" out of more than 400 miles per trip, and as for long continuous runs, 400 miles is nowhere. As long ago as 1876 the Jarrett & Palmer train made its great trip across the continent, and on the Central Pacific road, Engineer Henry Small took an old Schenectady engine and pulled that train from Ogden to San Francisco without a rest, a distance of 895 miles, and much of this mountain.

The Pennsylvania road is running an engine on express between Philadelphia and Washington that regularly makes 10 to 12 thousand miles per mouth, and has made 17,000.

M. N Forney has resigned his position of secretary of the Master Car Builders, a position he has long held with credit to himself and profit to the association.



Historical Locomotives.

SEVENTH SKETCH

We present on this page an engraving of the "Bee," No. 82, Lehigh Valley Ry., the first Decapod locomotive ever built.

This locomotive and her mate, the "Ant, 81," were built by the Norris Locomotive Works, Lancaster, Penna., in 1867, went into service in August of that year, and ran without change until 1883. They were first suggested by Gen'l. Supt. R H Sayre, and the details were worked out by Alexander Mitchell, now Supt. and M M of that road at Wilksbarre, Pa., and Mr. J. A. Durgin, then superintendent of the works that built them. Mr. Mitchell had designed and built the first consolidation locomotive the year before, a class that has since become the most successful heavy freight engine devised, and now used in almost every civilized country in the world The Decapods were designed for heavy mountain service, and were very heavy locomotives for that time, weighing 97,600 pounds.

They had wagon top boilers of $\frac{3}{8}$ iron, with a 50-inch ring at smallest part, with a sloping fire-box 120x34 inches, a combustion chamber 16 inches long and 180 2-inch flues 12 feet long.

Cylinders were 20x26, steam ports 18x1$\frac{1}{2}$ inches, exhaust 18x2$\frac{11}{16}$, travel of valve 5$\frac{1}{2}$, lap $\frac{7}{16}$, inside lap $\frac{1}{32}$. There were ten driving wheels 48 inches in diameter and a pony truck with 33-inch wheels

Rigid wheel base, 13 feet 6 inches, wheel base, on drivers, 18 feet 3 inches; total wheel base, 25 feet 6 inches. Total wheel base engine and tender, 48 feet, 5 inches The driving axles were 6$\frac{1}{2}$ inches in diameter These engines were a success in every way except that the long rigid wheel base caused the flanges to cut very badly on the crooked track where they were run.

The following letter from Mr. Mitchell makes this account authentic, and places the credit of the origin of what may yet be an important class of mountain locomotives where it belongs:

Editor The Locomotive Engineer:

Loco's Ant and Bee, Nos. 81 and 82, were suggested or proposed, and ordered by Rob't H Sayre, Esq., who was at that time, April, 1867, Gen'l. Supt. of the Lehigh Valley Railroad, and were specially intended for service on the grade of 96 feet per mile, for 12 miles on this road between Sugar Notch and Fairview. The details for these engines were worked out by John A. Durgin, deceased, and the undersigned Mr. Durgin was then acting as Supt. of the Lancaster (Pa). Locomotive Works, which were owned and operated by Edward S. Norris, Esq. The engines were put in service in September, 1867, and were used continuously until November, 1883.

A. MITCHELL, Div. Supt.

The engraving was made from a photograph taken at the Lancaster shops in 1867, and shows a handsome design and good proportions far above the average locomotives built twenty-two years ago. As will be noticed, the stack had a damper, and the old style half-stroke pump was employed. In 1883 these engines were rebuilt, received new boilers and had a pair of driving wheels removed—the Bee now having a pony truck at each end.

Decapod locomotives are in use on the Northern Pacific Ry., in crossing the Sierra Nevada mountains, and are also largely used in Brazil, and that the subject of this sketch is the first one of that class ever built, makes it an interesting and a historical locomotive.

Davis' Cylinder Head Tester.

At the Altoona shops of the P. R. R. can be seen a neat little machine for testing cylinder heads, the invention of Jos. Davis, Assistant M. M.

Considerable trouble was experienced from finding blow-holes and other leaks in cylinder heads after they were in place on the engines, which caused delay, as the head had to be removed to repair leak.

The engraving shows the machine, which is simply a pedestal with cap fitted to receive cylinder heads of different sizes and pipe attachments to bring water or steam under it.

Where a back-head is tested, there is a block, as shown, to bolt into stuffing-box.

In this shop water is used, and heads are usually tested to 200 pounds pressure; steam could be used to find leaks if necessary. This device also shows the deflection of the head under the various pressures, and thus points out defects in design.

The arrangement of starting valve, gauge and relief cock are plainly shown.

The lower joint allows the substitution of a different top to test steam chests or other forms of work, and the basin around base keeps the waste water from making shop floor wet and uncomfortable.

We believe a device of this kind will pay for itself in a very short time in any repair shop, in saving extra work and delay.

Care of Locomotive Boilers.

A PAPER READ BEFORE THE NORFOLK (NEB.) LOCOMOTIVE DEBATING CLUB.

By JAMES H. DAVEY.

In this paper I wish to give what experience and theory leads me to believe is the best practice for firemen, hostlers and engineers in the care of boilers.

Let us take a trip to Missouri Valley. We will inspect our gauge-cocks, and as we have at least one gauge of water and not more than three, we will fire up in ample time to get out of the house without working the blower, recollecting that the different parts of the boiler are of different thicknesses, consequently expansion and contraction are unequal unless the application of heat is uniform, and at first slow.

Getting out in the yard, we have our fire and steam all ready to leave on time; just before starting, the fireman opens the blower just far enough to keep the smoke out of the cab, and puts in coal enough, so as not to be obliged to open the door while pulling out on a fresh fire, thus avoiding a rush of cold air into the unprotected flues.

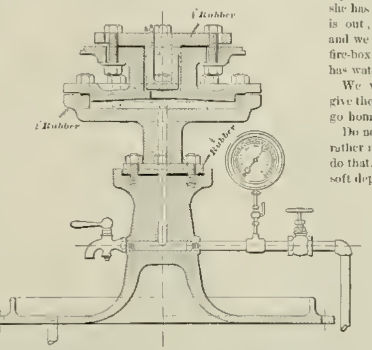
Getting out to the mile board, our engine—one of the F. E.'s best—shows signs of blowing off. So we put on the injector, setting it where experience has shown us it will just supply her. The fireman begins feeding her two scoops of coal at a time, causing the man on the second section just behind, and who, by the way, is firing four scoops, to wonder how the dickens that engine is running without smoke, while his is hiding the sun, and the chickens are going to roost, under the impression that night is coming. Yes, yes, Mr. Dissenter, we know that four scoops is easier firing, but this stoker is a member of the Norfolk Locomotive Debating Club, and is bound to take the coal premium.

Our fireman has been on with us several trips, so he knows where we shut off for Stanton, and his fire has no fresh coal when we push in the plug, and steam has dropped back about ten pounds; he drops the damper, and the injector works for a minute or two, until we think she will not pop off. Right here we would say these are the only occasions when the injector works while the damper is down, and then only for a minute or two.

After stopping at Stanton a few minutes, the fireman—who is watching the hind end while the engineer tries to borrow a little black oil from the brakeman to help out his oil record—sees indications that they are about ready to go, so the blower goes on very gently, and in goes from four to six scoops of coal, and away we go, having plenty of time to ring the bell for all those street-crossings, look out for teams, and see that the caboose is coming.

Well, after all, our fireman is only human; so, just on top of the grade, four miles east, he gets her too hot and she begins to sputter. If our boiler was in the least predisposed to leak, he lets her pop; but she is all right, and he swings the door to and fro a few times and she gets reasonable again.

Everything goes on all right until we get to Hooper. Here we are laid out four hours for a work train, and our water gets low; steam is up to 130, but we drop in more coal and work the blower while the injector is on. May be she will blow off



a little when the squirt is shut off, but what of it? We are taking care of boilers now. Here comes the work train at last, and we are off again. Our fire got spoiled lying at Hooper so long. Some firemen would open both dampers, but ours don't. He knows that the area of his front damper is large enough when the ash pan is clean—and it is never any other way on this engine—to furnish oxygen, nitrogen, hydrogen, or any other kind of gin, for the biggest hog that ever climbed Blair hill.

Fremont at last, and, just as usual, two hours switching. At it we go; pretty soon fireboy thinks a few scoops of coal is needed. Does he wait until we start out of a siding, with fifteen or twenty cars, and then open the door and slam it in? Oh, no! He thinks too much of those precious flues. Yes, 'tis true they ain't his flues, and the company has lots more, but he expects to stay on this engine, and he's a little bit lazy anyway and don't want to shovel any more coal than he has to. And say, did you ever notice how hard it was to get some of those new flues put in? He has another scheme: Just before he expects to get a stop signal the blower goes on very easy, the "shack" three cars back can't hear it, but it's on. Then here comes the signal. Whoa! down he jumps, fires in two scoops, and is on his seat again quicker than you could say Jack Robinson, repeating it on the next stop if necessary. He has not missed a signal, and if he has, what's the odds? You are not going to smash any cars by taking your eye off the gun on a stop signal. Meanwhile we have been losing water, we put on the injector, working it as fine as we can, but still it throws too fast for switching; so we knock steam down ten pounds, then shut it off. Cast-iron rule: Never knock down more than ten pounds of steam with an injector.

Going over Arlington hill, our engine did not steam very well, owing to dirty fire, and we were obliged to let the water drop until she showed but one gauge after tipping over the summit; with blower on and damper open she was in good shape again at Kennard.

We get to the coal dock with 100 lbs. of steam, three gauges of water, drop damper and get off, and now—for home? No; let's stay and see the hostler operate. What makes the exhaust sound so funny as he runs her over the clinker pit? Yes, just as we expected, he is working steam with dampers closed. We must give him a pointer about that. Hostler goes off on other business, and up steps his helper, puts on blower full force, opens fire-box door, and looks in, then recollects that he forgot to bring up the slash-bar and starts to hunt it up, leaving door open. Pretty soon he returns with it, pokes at fire for a while, then goes on the back end of the tender for the tongs. Door still open. Give him a gentle hint that it would be better to work blower light and keep door shut, when not knocking out clinkers.

Be careful how you speak to him, for he is very sensitive, and is apt to ask you, "Who owns this engine, and how much did you pay for her, anyway?"

Hostler puts her in the house and goes to working injector. We kick on that right off. "Why," he says, "she has 100 lbs. of steam." Don't care if she has a thousand: don't work injector when fire is out, the flues contract faster than the sheets, and we don't want rollers and calking tools in our fire-box. Ascertain before knocking out fire if she has water enough to go in the house.

We want our boiler washed this trip; so we give the boiler washer a few instructions and then go home.

Do not blow the steam off my engine; I would rather not have it washed out if you are going to do that. The sides of the boiler are covered with a soft deposit of lime salts which will turn into scale if the steam is blown off, leaving the metal hot. A piece of scale from the side sheets of a boiler habitually handled that way will show how many times she has been washed out by the number of layers there are in it.

This plan also bears rich fruit in the shape of broken stay-bolts and cracked sheets, the cause of which is too obvious to need discussion.

Wait four or five hours, then open blow-off cock under the cab, and when the water is about half out, connect your wash-out hose to injector pipe and cool her off gradually, leaving blow-off cock open, of course. Some boiler-washers, having a deep-rooted dislike or uncontrollable aversion to physical exertion, will leave the plugs in boiler head and upper hand-hole plates severely alone. We hope you are not one of that kind. Put about a gallon of black oil in boiler before filling; it will do much to prevent the formation of scale, and the valves won't cut the next trip, either.

Well, we have a clean boiler; consequently we save a bucket of coal on our next trip.

Right here I wish to say that, in my opinion, the company gets better returns from the money they pay the boiler-washer than from any other investment.

[This club was formed upon the suggestion of THE LOCOMOTIVE ENGINEER, in March, and already numbers over 50 active members. We are glad to publish this paper, as it goes to show the way roadmen take hold of such subjects. The case cited is local, and the practice might not be just the thing for other roads under other circumstances. But the reading and discussion of such papers by the enginemen of any road is worth money to the company, and such clubs ought to have encouragement and support. Engineers and firemen who take part in any such entertainments are helping themselves up in their profession.]

The Beals Brake Co. have been fortunate enough to secure the services of J. H. Vreeland, late M. M. of the Eric shops at Jersey City.

A Rip Van Winkle Shop.

The Fitchburg road recently passed a dividend (without paying it), and stockholders desiring an explanation can find an illustrated one in the Troy shops. This museum of antiquity, by courtesy called a shop, would be a disgrace as a country blacksmith shop in Patagonia. It is over 25 years old, of rough boards, with windows set about four feet from a high hill on one side, and none on the other, there are a couple of tracks through its center, and a turn-table behind it; in little sheds against one side of the main structure there are blacksmith forges and the master mechanic's office; on the other the machinery. One beauty of this shop is its location; it is built right in the way of the main line tracks, which are run around it

They have here an old screw-wheel press, a few old lathes, a planer (brought over in the "Mayflower"), wooden drill presses, and a boiler shear—worked by a pole and held down by a timber placed against the roof.

They turn drivers on an old lathe of large swing, working on but one tire at a time. They bore car wheels by chucking them in a lathe, and other work in proportion In the shop they were rebuilding an old Hinkley, inside-connected scrap, that would not bring 35 cents on any road in the country.

Mr. Davis, the M. M., and his foreman are not as old as the machines around them, or the dirt floor under them, and know that there are wheel presses and wheel lathes and boring mills that would do their work in half the time for half the money, and do it twice as well, and are not the ones who are responsible for the place.

If a photograph of these extensive works of prehistoric ages were furnished to stockholders, it would be all the explanation necessary for the postponement of dividends until this shop rots down—which, judging from present appearances, ought to occur some time before frost comes again.

Indicating a Locomotive.

By CYRUS F. RICHMOND.

FIRST PAPER.

You can talk about balloon ascensions, Rob Roy canoe trips and wheelbarrow rides across the continent, but for real excitement and novelty of adventures, I think a trip on the front end of a locomotive beats them all

GETTING READY.

Our occasion for such a trip was for the purpose of making a series of tests, to determine the amount of water evaporated per pound of coal consumed, and the power developed in each cylinder. The tests were made in six consecutive days, while the engine was hauling a regular passenger train of about seven cars.

The sketch shows plainly the apparatus used on front end for making the test. It was designed and arranged by Mr H. G Manning, who conducted the test, and has some features not always used, for instance, the arrangement to tell where reverse lever is, and the steam gauge—these arrangements do away with the necessity of a man in the cab to note pressure and point of cut-off. These tests were made in September, 1888, on engine 88, Central Vermont R R.

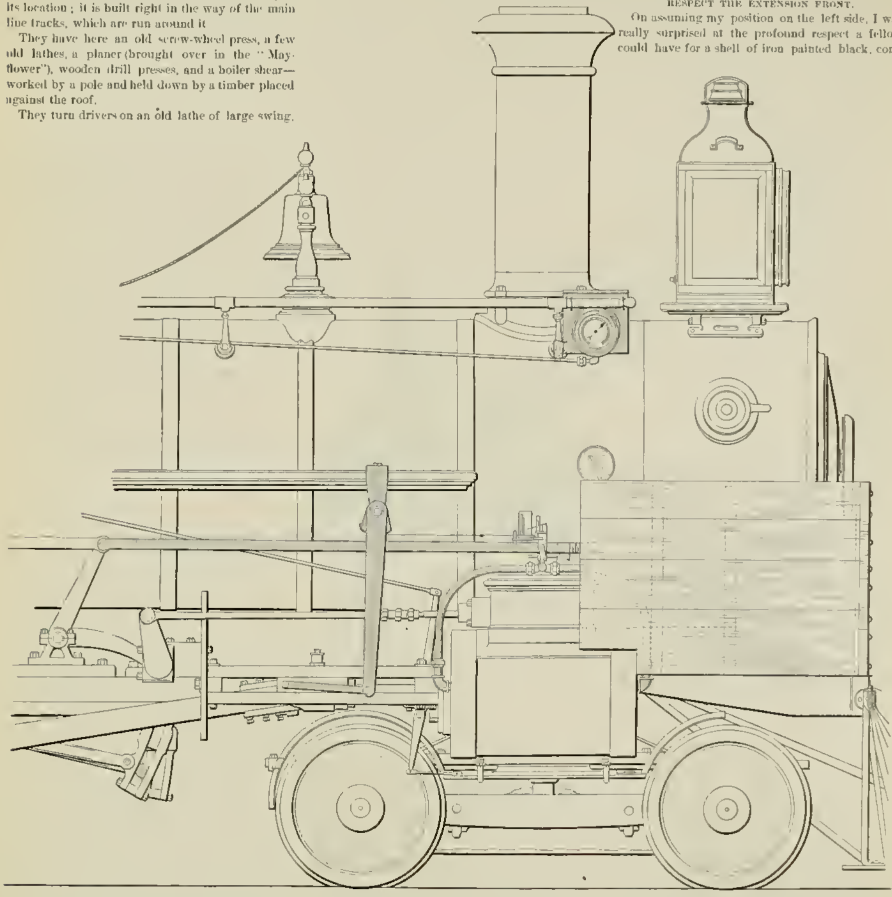
Of course, the cut only shows one side of engine; would say that the other side was rigged up the same way, with the exceptions of the steam gauge shown tied to hand-rail, and rod attached to upper lifting-arm pin reaching over top of steam chest, to show in what notch the reverse lever was at all times.

The rigging up had to be done in one day, consequently, my partner and I were somewhat afraid some little detail might have been overlooked, so we were up at 4.30 A. M., with clear heads, to go over the rigging before starting out. But, with such caution, it is always the unexpected that happens. So the reader may profit by our experience, and be ready for such ordeals, should he ever have occasion to indicate a locomotive.

RESPECT THE EXTENSION FRONT.

On assuming my position on the left side, I was really surprised at the profound respect a fellow could have for a shell of iron painted black, commonly called the extension front, and let me assure you I maintained that respect throughout the tests, and never once tried to fondle or embrace it, but settled right down in the space allotted me, and as we moved along at such a rapid rate, with so much ease and grace, I began to feel charmed, and imagined I was journeying heavenward, until we made a stop, then I thought the engineer had stopped at the wrong station, for a fellow can't stand between the smoke arch and boiling hot sun, boxed in like that, without bringing up old memories of Sunday-school stories of a place they don't wear overcoats.

One of the first unexpected things we had to grapple with was a great leak of steam which I was unable to locate from being boxed in so, but it was close enough to me to make it so uncomfortable that I had to go back to the cab and wait until



we made a stop. While sitting on the fireman's seat and watching the clouds of vapor rising from an unknown quarter, I was startled to see the top of the indicator shoot up like a skyrocket and land in the grass on the road side, which was unexpected No. 2.

I left unexpected No. 1 for my superior to look out for, while I got off at a near-by station, and with an army of boys and a section gang started in search of the truant indicator top. After an hour's search it was found by the ever-present small boy, and to my surprise nothing wrong with it.

Would say right here that we had to watch them close after that, as the only means provided for screwing them on was with the fingers, and the jar would work them loose quite frequently.

There should be a half-round Spanner wrench, with a teat on end and a hole in knurled collar to receive it, then it could be screwed down tight.

THE RELIEF VALVE.

The engineer said that I must be a "Jonah," for after I left they had no more trouble with the escaping steam, and it looked that way to me, for on the return trip my indicator cord broke, and while holding a new piece in my hand, ready to adjust as soon as we slowed up, I let it hang carelessly, and when I was about ready to tackle the great contortion act of adjusting it, the old steam leak appeared again, and I thought it must surely be the devil on my side, for something had hold of one end of my cord, and wouldn't let go, so I followed down to the end of the cord and found that it had been sucked up in the relief valve when steam was shut off, and as soon as the steam was let on again it pressed the valve down, with the cord caught up in it. Here was our unexpected No. 1 unraveled. To share the cuss words, my partner got his watch-chain caught up in the valve on his side, and I verily believe be would have been drawn up himself if he had been attached to the chain.

All this was remedied by boxing around the valve shell *tight*; we had boxed around it, but left a few loop-holes for waste, paper, string, watch-chains, and possibly men to be drawn up and squeezed down again.

Speaking of indicator cord, it is always best to have a few cut the right length, rigged handy to adjust, for they are liable to break, and it generally happens when you have the least time to spare.

ARRANGEMENT OF SIGNALS.

We had a sort of primitive telephone rigged from one side to the other, but it was difficult to hear, on account of noise, etc., so my superior tied a string to one of my wrists to signal me when to take cards, but it didn't work, as he would yank my hand when it was near the oil-cup on top of steam chest, and leave a red-hot impression on my hand—as well as my mind—and also bring out a red-hot expression. So we let the string go rather than be prematurely cremated, and replaced it with a small gong, which, with proper signals, understood, worked nicely.

HOW TO COUNT REVOLUTIONS.

Counting the revolutions—or chewing lightning, as it sometimes seemed to me—was another sticker for me, but not for my partner. It is all well enough when they are not over 200 per minute, but when they run above that, it takes an experienced hand to get them correct. Practice is all that is needed to become an "experienced hand," so I practiced in my leisure moments. There is a suggestion that is worthy of notice for one who has difficulty in counting, and that is, to count up to ten, and instead of saying eleven, twelve, etc., commence with one again and count 9, then say twenty and commence on one again, count 9, then say thirty, and so on. In this way it will soon become easy to count as high as 80 in fifteen seconds. I believe there is no counter made for this purpose, to use on locomotives, that can be relied on, so it is necessary that one should be capable of accuracy in rapid counting.

The last and most trying to the patience of the experimenter, and yet, after all, the most amusing, was the number of questions from a curious public we had to answer. One in particular I call to mind now, was from a real honest-looking hayseed, who put the query to my partner after this fashion: "What yer got thar, a hog-pen?" (pointing to the boxed front end) which was probably suggested to his mind by the appearance of its occupants, after several showers of soot and cinders, mixed with sweat and wrath.

In next paper I will try to briefly describe the indicator and its action, and explain how to take the cards, and how to read them after they are taken.

Light Steam Hand Car.

We present on this page a cut of a very small locomotive of standard gauge, intended for inspection work and roadmasters' use. It is the invention of Mr John Doyle, general roadmaster of the Detroit, Lansing & Northern Railroad, and is being introduced by The Ionia Steam Hand Car Co. of Ionia, Mich. As will be seen, the little upright engine drives the forward pair of wheels by means of a chain, or linked belt, and sprocket wheels. All the parts are as light as possible, the whole machine, ready for the road, weighing but 700 pounds. The car is built to carry four persons, but can be rigged to carry more. The water-tank holds 16 gallons of water, and the coal bunker a couple of scuttles full. The boiler is a quick-steaming one, and can be got ready for service in from 10 to 15 minutes. The average speed is 15 to 20 miles per hour on one gallon of water, and from one to two pounds of coal per mile; they have been run at 30 miles per hour The car is so light that one man can take it off the track on a road crossing, and two men can handle it any place. Something of this kind is needed now-a-days to enable track, bridge, fence, and tele-

graph men to go over the road at a good rate of speed without the employment of a regular locomotive, train orders, or a crew. With this little locomotive an inspector is his own boss, can stop where he pleases, as long as he pleases, and go when he pleases.

A few of these little fellows along a road would be a great help in case of accidents, to send out with physicians, take orders, or bring in crippled people. If one of them gets against a full-grown locomotive, the damage is slight in comparison with ordinary locomotives in collision.

A New Valve Motion Model.

We have received a very handsome photograph of a valve motion model, built by W. H. Ermentrout, of Reading, Pa. The design of the model is much like the Richardson, but it is gotten up on a cheaper plan, being mostly composed of hard wood. It is adjustable in almost every way, except the radius of the link The price is not stated.

A Victory for Contracting Chills.

The Central Railroad & Banking Company of Georgia have placed with A Whitney & Sons, Philadelphia, an order for 10,000 car wheels, to be cast in contracting chills—enough to keep these great works in full blast for several months.

John Alexander's fit of modesty has become contagious. Master Mechanic Phelan and Ry. Com'r M. E. Conger request the dropping of their respective titles; they want to be just "one of the boys." Modesty is a good thing to have—modest ourselves.

Correspondence

From the Pacific.

Editor The Locomotive Engineer:

Herewith find enclosed one dollar for the renewal of my subscription to THE LOCOMOTIVE ENGINEER. Could not do without it, each one of John Alexander's letters is worth more than the subscription price for one year. Come again, John; the boys in far-off Oregon relish your letters. And by the way, he speaks of a locomotive riding bad when cut back with full throttle; and for the benefit of some of the readers of THE LOCOMOTIVE ENGINEER, we would ask why it is that an engine gets up this side motion and seems to labor against herself when cut back with full throttle. I claim that it is back pressure. If wrong, please correct.

McMinnerville, Oregon. "OLD TIMER."

Room for Improvement.

Editor The Locomotive Engineer:

There seems to be an impression among engineers and firemen, that there is no use for them to try and invent or patent any improvement in the line of their work, and often say that it is no use for them to think of it, when master mechanics and superintendents of machinery have been working in the same line so long.

Keep thinking, and when you have an idea work it out, and be sure it will work before you announce it. Don't be discouraged by apparent obstacles—sometimes a little light from another source will make apparent failure a success, so do not be afraid to ask advice. If you look back to the record of past achievements in locomotive, steam engine or machine designs and improvements, most of them were made by men in the ranks, and not by experts Don't dream, like our friend John Alexander; dreaming never made an invention, but solid thinking has. I know you can't get up a patent every time you think, but keep thinking. There is room for improvement. F. W. K.

No. Germantown, N Y.

"Signals."

Editor The Locomotive Engineer:

Often when sitting comfortably in a good seat in the smoker enjoying a cigar while the gentlemen in the cab were doing their best to make up that 10 or 20 minutes we had lost, the importance of having good signals has occurred to me. As we roll around a curve, and dash by a freight standing on a side track, I think of the possibilities arising from that switch, should it have been left open to the side track, and no semaphore or other signal in such a position that the engineer could see it in time to prevent our making a serious reduction in the surplus of the road—if it had any. I do not suppose that the engineers are consulted very often on the matter of signals, but I am prompted to write this by the belief that they can give to those who are interested in such matters many valuable hints gathered from every-day experience. I know of no one more competent to judge of the best form of signal by day or light by night, than the men upon whose shoulders rests the responsibility of knowing the meaning of every signal on their run.

It is the opinion of the writer that the subject of signals is receiving more attention in this country to-day than ever before, because of the rapid increase of traffic, and consequent addition to the number of trains run on the majority of roads, and the advantages shown by those roads which have good signal systems in use.

I wonder how many trains would leave or arrive safely in the Grand Central station, New York, in 24 hours, if the present system of signals was abolished, and they returned to the old-fashioned switch-stand and target.

I hope some of your correspondents may find time to tell us how they think a danger signal should appear so as to prevent them from doing that which might result in loss of life and property. SMOKER.

Poughkeepsie, N. Y.

Simple Rule for Setting a Slipped Eccentric.

Editor The Locomotive Engineer:

I see in the paper different rules for setting slipped eccentrics, but none just my way, which I think the simplest.

For a back-up eccentric, place that side of engine on the forward center, put the throw of eccentric *down*, and then move it toward the pin enough to give the amount of lead, and fasten.

For a go-ahead eccentric, place engine on *back* center, and proceed the same.

It is no trouble to set eccentrics, if a man knows where they ought to be; a young runner will generally have more trouble to tell which one is slipped, and my way of setting will show him what one is off as soon as he gets the engine on the center.

I recently saw a young runner trying to set a slipped eccentric by the cylinder cocks, when the real trouble was a broken follower head.

Charleston, Ill. C. W. K.

The Reading Relief Association.

Editor The Locomotive Engineer:

By your inquiry as to whether the employes of the P. & R. R. R. Co. take kindly to the Relief Association instituted as adopted by the company, I infer that you are familiar or acquainted with the relief system as it is practically conducted by railroad corporations of the present day. In reply, therefore, if I may be allowed the comparison, I should say they take to it as kindly as a chicken would take to a body of water it might by accident fall into. In connection it might not be inappropriate to assume that a couple of foxes were on either hand with an eye single to the ultimate good to accrue to themselves as the result of the chicken's misfortune.

From the foregoing you might be led to think that there were some urgent methods brought to bear, compelling the employes to identify themselves with the scheme. I am constrained to inform you that such is not the case and, as nearly as possible, quote you in proof President Corbin's own words, found in a circular published and issued to the employes about the time the organization was being effected, in which he said: "I wish it clearly understood that all our present employes are free to become members or not, as they please, and none need have any hesitation in declining, if they desire to do so." In view of this position taken by Mr. Corbin, what appeared most singular, after hearing the numerous sarcastic and unfriendly comments on the project, as expressed by the employes, was to note in how remarkably short a period of time, with few exceptions, almost every employe had filed an application for membership. Indeed, I question whether there has ever been any similar distinctively beneficial organization in existence that has in so short a time received such large accessions to its roll of membership, and apparently three-fourths of them joining much against their will.

I will intrude on your time no further than to add that, as there are always two sides to a question, this subject would admit of a large and varied discussion *pro* and *con*; but you have, no doubt, gathered enough from the tone of this communication to appreciate the true circumstances of the case.

In conclusion I would earnestly solicit an expression of your opinion on this subject, to be published in your next issue, in connection with the above.

Reading, Pa. SUBSCRIBER.

That Bent Main Rod.

Editor The Locomotive Engineer.

It is a late day to find fault, but I believe in the old maxim, "Better late than never." I am not satisfied with your answer to my question in November number, 1888, about that bent main rod. I believe yet the bend was caused by the engine catching herself on sand, when she was working steam. In your answer you say no (and I believe, without giving the subject any thought,) that the main rod could only receive the pressure of steam on piston. Now we all know that when an engine is passing the bottom quarter in going ahead, the action of steam is pushing on piston and rods, and, in passing top quarter, is pulling. Now in my case my sand would run only when fed out by hand, and I had a man out for that purpose. Now, suppose she commences to slip, and before I can close the throttle, he drops some sand and it catches her when the pin is about passing the lower quarter and the rod is in an angular position. Now I claim that the sand, in having a tendency to stop and steam to continue, causing the engine to slip, working in direct opposition to each other, might cause the bend. Of course it might be caused some other way.

I would like to have the opinion of our M. M.'s, etc., on the above. If my theories are wrong, I wish to be corrected. If we don't fight over this rod, I will tell the boys in some future number how we took the bend out of that rod.

McArthur, O. W. R. CLINE.

[If the engine was slipping badly the sudden checking of the momentum of the moving parts might have thrown more pressure on the rod than that due to the steam pressure, but how it would tend to bend the main rod instead of bending or breaking the guides or crosshead, does not appear plain.]

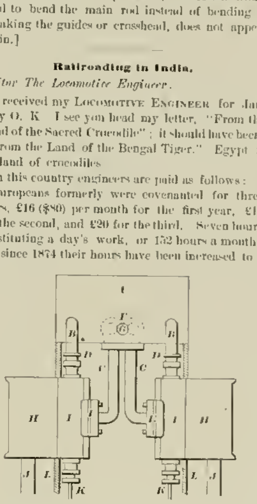
Railroading in India.

Editor The Locomotive Engineer.

I received my LOCOMOTIVE ENGINEER for January O. K. I see you head my letter, "From the Land of the Sacred Crocodile"; it should have been, "From the Land of the Bengal Tiger." Egypt is the land of crocodiles.

In this country engineers are paid as follows:

Europeans formerly were covenanted for three years, £16 ($80) per month for the first year, £18 for the second, and £20 for the third. Seven hours constituting a day's work, or 152 hours a month, but since 1874 their hours have been increased to 8



per day, or 205 per month. £16 is 160 rupees in Indian money.

If a man works short of a month and is always available, he is paid the full month and Sundays at 7 hours per day overtime. If his engine is under repairs and he only works the four or five Sundays in the month, he gets one month's pay, ordinary time, and Sundays overtime. He gets 10 rupees per month, good conduct money—this is payable quarterly.

He also gets coal and oil premiums, provided he keeps time and runs lower than any one else.

With Indian coal my passenger engines are running on 35 pounds of coal per mile, and about 6 quarts of oil per 100 miles; average load 14 vehicles.

We have several classes of coal; the best is Rambilli, equal to best Newcastle coal and it takes measurement at 42 cubic feet per ton. With this coal a very light fire is carried; only enough to cover the fire bars is sufficient to give plenty of steam. We use smoke plates and brick arches for all classes of coal.

I expect to leave this station for another this month, and will notify you, as I want the paper sent me—I like it very much.

I see a great many foremen write you about steam pipe repairs. We use pipes that are glanded on to the steam chests, as are also the exhaust pipe; this allows for a certain amount of expansion.

You will see by the sketch that we set the cylinders back of the smoke-box, as in English practice; this allows of the use of a large, single, leading wheel.

For the benefit of young Americans not familiar with this style of engine I designate the parts in the plan. *A* is the smoke box, *B B* steam pipes, *C C* exhaust pipes, *D D* steam pipe glands, *E E* exhaust pipe glands, *F* breeches pipe under exhaust pipe proper, *G* nozzle or blast pipe, *H H* cylinders, *I I* steam chests, *J J* motion bars (guides), *K K* eccentric rods (valve stems), *L L* plate frames. Main steam pipe in the boiler generally lasts the engine's life, *i. e.*, 50,000 miles to first boiler examination. The steam pipe joints in smoke-box generally last 14 days, but according to work; if on heavy flagging, less time, to disconnect and make joints, 1 to 2 hours. This is on Dub's passenger engines.

FRED. W. BEDFORD,

Sohagpur, C. P., E. India. Loco. Foreman.

Some More Kinks for Young Runners.

Editor The Locomotive Engineer:

John Alexander says that he has invented a great many "kinks" in locomotive practice, some of which were successful when put in practice, while others were conspicuous failures. There are others of us in the same fix, but our surroundings have a great deal to do with the success or failure of most of the devices for getting ourselves out of troubles brought on by poor machinery, bad roads, etc. What will be described in the following lines probably will not be of much use to a man on a first class road, with plenty of machinists to do the work, a shop at each end of his run, and everything in apple-pie order. But for the men on roads where the train dispatcher is in charge over the master mechanic, or where the engines and men are on the "chain gang," or where the only shop is in the middle of the road, and at the end of a trip the engine is put on a rotten old wooden table, hand-spiked around, run into a wooden shed with no pit in it, and a sand floor to do your work on, there is where some kind of kinks come very handy. When you get in at night after monkeying along with a hot brass all the way it is not very cheerful to think of having the same trouble all the way back again the next day. If you are troubled that way, get a bar of solder from the tin shop, commonly called "half-and-half," a little vial of acid from the same place, and some emery paper. When you get in at night, throw a link into the fire-box where it will get red-hot. Take out your brass that has been hot, rub the bearing surface bright, wet it good with acid, fish the red-hot link out of the fire-box, and lay Mr. Brass on it so it will get hot, too. When the brass gets hot enough to melt the solder, rub the end of the bar on the bearing surface till it is tinned over good. It should be a little thicker in the middle of the bearing than at the edges, so it will run cool, and, if you do a good job, that brass will be pretty certain to run cool till the tinning is worn off. Try it. I hear that the patent for lead-lined brasses covers this process, if it does, it is no good, for I have used this plan for fifteen years.

Some men have an idea that an engine, with two injectors and no pump on, has to be filled up with a hose, or with a pail through the top of the dome. If your engine gets cold this summer, and the water drops down so low you dare not put a fire in her, and there is another engine there that can tow her around, hitch on to the dead one, oil your valves and cylinders good with oil—not tallow—hook the reverse lever the way the engine is going, open the throttle wide, and when the engine is moving, the cylinders of your engine will take the air out of the boiler; if the tank is full and *all* steam and water connections to both injectors are open, the water will soon fill it. I have seen an empty boiler filled up in this manner, in one trip up and back, in a 50 car siding. If the air leaks in through the whistle, or relief valves on the steam chest, wet some waste or a pair of overalls, and tie around them, to keep the air from getting into the boiler that way, for if the air gets in as fast as the cylinders take it out, the water won't have to go in. I have used this plan myself several times, and it works well.

Now these kinks are for the use of the men who are learning the business; and it may seem useless to the old, experienced engineers to write about them, but just the same, there are some old engineers that think the right way would be to reverse the engine and pump air *into* the boiler, and use air to work the injectors. That won't do it, for compressed air won't work an injector. Steam will do it, just as long as the stream of water will condense all the steam, and no longer, and that is the reason why very hot water will not work through an injector readily. If the steam does not take up all the water, it comes out of the overflow only warmed, if the water does not condense, or take up all the steam, it will "break." You may theorize all you please, but the injector depends for its action on the complete condensation of the steam, which is the propelling power that sends it into the boiler. No matter how small the leak, if the injector draws air it will break, because water won't condense air as it does steam. Another kink is to fasten the nozzle of your squirt, for wetting the coal, so a little stream of water will run on the rail behind the drivers, and wash off the sand you have to use on a hill, and make the cars come along easier. The best place to fasten it is with a loop of telegraph wire on the lazy cock, if your hose is long enough to reach down there. On the outside rail of a curve, it will help you enough so you can get around with a train, that would otherwise stall you, and make you double the hill. One master mechanic thinks enough of the plan to have a little jet of water thrown on each rail behind the drivers, and he has a special set of pipes to do the work in a first-class manner. He did not get the idea from me, either, so you see the plan is not new.

Next winter, when you find your frost glasses troubling you, by "sweating" on the "inside," fill in the space between the two glasses with alcohol, and it will be clear as air, and won't freeze, either.

CLINTON B. CONGER.

Lansing, Mich.

About Steam.

Editor The Locomotive Engineer:

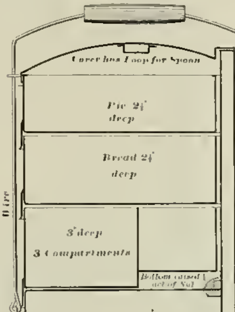
Don't you think that it would be better for us all, as enginemen, if we would, through the press, or in some other way such as might be deemed advisable, relate to each other our experience on and our knowledge of our engines, the construction and working of the different parts of the machinery? We all know the name of the invisible and powerful agent which propels the locomotive with its train of cars along the iron track. We see it toiling for the human family in every land on the face of the globe; it has been connected with most of the great engineering works of the past century. Some of us have seen that great masterpiece of engineering skill cut across the African desert, connecting the waters of the Red Sea and the Mediterranean; and as we stood on the deck of the steamer, and viewed with wonder and amazement this great work of the century, we felt convinced that, without the aid of this mysterious power, the Suez Canal would never have been cut, the short highway to India would have never been opened. It brings to our shores and lays at our feet, and distributes in every city throughout the land, the products of foreign countries. Spices from India, the teas and rice of China and Japan, and a thousand more of the necessaries of life. Through its agency the Atlantic voyage between Europe and America has been shortened from weeks to days; we see it turning the wheels of our factories and our mills, we find it heating our public buildings, our churches, our schools, and our homes; it is employed on all the great highways of commerce, both on sea and land. Every boy and girl knows that this great friend of the human race is called steam. Some men have been in close communication with it for years; they have thousands of times opened and closed the throttle by which its mighty forces are held in submission; they have heard its shrill voice as it was released from the cylinders and safety valves; but ask them the question, What is steam? and they are silent; they don't know. Steam is water changed into gas by means of heat, and in its true state is invisible; it will, like all other gases, expand if it is enclosed, and its pressure will be equal on all sides of a cylinder in which it is enclosed. There are two kinds of steam, called saturated and superheated steam. Saturated steam is in contact with water, if it is separated from the water, it can be heated to a higher temperature; it is then called superheated steam. When we were boys at home, we have often watched the white cloud escaping from the spout of the kettle, as the water it contained was boiling over the fire. Since we became men, and commenced locomotive work in order to earn our daily bread, we have often seen this same white cloud escape from the exhaust pipes and cylinder cocks of our engines. But this is not true steam; it is then in a state of condensation, through coming in contact with the atmosphere. Now if we take water, and boil it in any open vessel, the steam which escapes from the water, as it boils, will have a pressure equal to that of the atmosphere in which it is boiled. In ordinary cases, such as on level or low lands, the atmospheric pressure is 15 lbs. to the square inch; on high elevations it is lower, and below the surface of the earth, in mines or deep wells, it is higher than it is on the surface. If we admit steam of 140 lbs. pressure into a cylinder, this is called absolute pressure; if we deduct from this the atmospheric pressure, 15 lbs., we have 125 lbs effective pressure. In graduating steam gauges the atmospheric pressure is disregarded, so that if we speak of having 140 lbs of steam, we mean effective, and not absolute pressure.

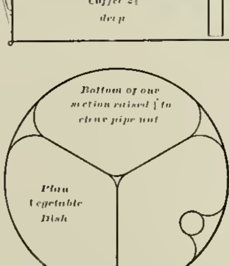
F. TAYLOR.

Marion, Iowa.

John Alexander's Dinner Pail.

Ever since John Alexander gave a description of his ideal dinner pail, we have been receiving letters asking if they could be purchased, if we had a picture of one, would we please give Mr. Alexander's address, and one man sent $2 and said, "Get me one, if it costs $10." We wrote to our festive correspondent, and depicted our woes to him, and he answered as follows:





Editor The Locomotive Engineer:

"Uneasy lies the head that is a clown's.' This is the eleventh letter from you about dinner pail. Can't a fellow say what he wants, without all the people in the land rising up as one man, and saying they want it too? Did I tell everybody from Dan to Bersheba that I had dinner pails to sell or give away? I had one of these pails made, as near as a country tinner could build it, with no other facilities than a soldering iron and a piece of rosin, and it looks a little (not very much) like the sectional sketch sent you herewith. I don't know which is the worst, the drawing or the pail, as I have no means of comparison—some fiend in human form nipped the pail the second trip out—I wouldn't care so much, but I had left a quarter section of cream pie to top off on after I registered, and the deep-dyed villain took that, too.

Well, here are directions for building and operating the device, such as it is. The bottom is 2¼ deep by 8 inches across, and the brass nut is soldered into it and tinned over, to keep it clean. The pipe is ½ inch copper, and tinned or nickel-plated, outside and in, this makes it easy to clean. It extends to top of pail, so that a man can drink without taking the pail apart or getting cinders stuck in the larinx, or something, of his Adam's apple. The next story is partitioned off into three compartments, as shown in the separate sketch. These are for vegetables, and when the pail is put on a stove or the boiler head to get the coffee hot, it gets the whole lunch warm. I would place the hole for pipe in one of the partitions, but for the fact that one of the sections has to have its bottom raised to clear the pipe nut, corners are rounded.

The other sections are shown and sizes marked on, in sketch; any one that knows enough to eat a lunch can see that he could open one of these sections without the other, by raising up and swinging on the pipe. I did think the bail should snap around the pipe, but the plan shown works O. K. It would be better if the pipe extended through the cover and had a cap on it, but I preferred the style shown, because it was easier made and kept clean. If there is as much talk as all this about a jim-crow dinner pail, it would seem to a man up a gooseberry bush as if it would pay some outfit to make a few and dispose of them to the meek and hungry car hands who read the L. E. Should any tin peddler come to you with propositions tending to make him the bloated monopolist and millionaire manufacturer of John Alexander's great and only fodder can, inform him that I seek the good of all mankind, and will therefore sell, barter or bequeath all my right, title and interest in the aforesaid dyspepsia dispenser for a small consideration in the current coin of the realm.

JOHN ALEXANDER.

Not in Canada.

Editor The Locomotive Engineer:

I should like to see the opinion of a few others upon the practical working of a close cut-off with link motion. J. Alexander's idea of "hippity-hopping on tip-toe" just about hits the mark. I am running an engine which, with the lever in first notch forward from the center, cuts off at about 3 inches, and I find it goes fine on a slight down grade; but on a level she slows up till the exhaust gets about the same volume as when working with the steam wire-drawn from a throttle almost shut and the lever in the next notch below; whilst the old lady wriggles and prances on the rails, something like a high-fed colt in want of exercise. So, in consideration of a slab frame and side play in the boxes, this notch is not polished very much. It does not save coal a cent's worth, either; besides, if she happens to get down on one of her springs you have to listen if one of her exhausts is going down onto the track somewhere, instead of up the stack. No, sir; if a man wants to get his name up for cheap running, he had better go dodging along the road, letting other men take side tracks, etc., etc., or have an understanding with the coalmen to dump extra good coal into his tender, especially if he has very cold weather to pull against as we have in.

CANADA.

Montreal, Can.

Thoughts on the Center Notch.

Editor The Locomotive Engineer:

In the technical department of a certain monthly journal it is asserted, in substance, that reverse lever in the center notch and throttle wide open is proper. My experience on the road convinces me that there is nothing in it, and nothing to be gained or saved by running an engine on such principles. My experience in the back shop, facing valves and doing other valve gear work, is that it is injurious to the engine and a detriment to her on the road. Let us suppose a case. An engineer pulls out of a station, say, with a heavy passenger train; by the time he has run a mile (if the road is level) he has the lever up in the center and the throttle wide open, and nine times out of ten the minute this occurs the valve stem and piston rod will begin to blow, and he is at least two or three miles from the station before the engine is making card time; and it is a struggle, yank and twist, with the engine, to handle the train; but suppose, when all is said and done, she is not making time; we drop the lever down a notch or two; if we do the throttle must be closed in proportion, or she will pull the fire to pieces; and if such is the case—and experience tells us it is—why is it not a great deal easier on the engine? and she will pick up her train quicker, by cutting back and opening the throttle by degrees, giving the engine just what steam she requires to do her work and run along smooth.

If an engine will not keep increasing her speed (with an ordinary train) with the reverse lever in the center and a full throttle, it proves conclusively that the principle is wrong. I make the claim that throttle and reverse lever should be in such a position in relation the one to the other as to leave us some margin to fall back on in a pinch. I tried the experiment once (with an ordinary train) by running my engine with the lever in center and full throttle; she would only run so fast, I did not change the reverse lever, but closed the throttle a little, when she began to pick up in speed; I was convinced at once that it is not right to throw the whole boiler pressure on the valves and increase the friction by making them carry an unnecessary load. It is a good rule to run with the reverse lever as far up as is consistent with the work to be done, and the throttle in such a position as to give the engine just what steam she requires, and no more. I have faced valve seats that were cut down one-eighth of an inch in center, and the planer tool marks still visible at the extreme full travel of the valve; all this wear being done in one trip of 214 miles, and the whole thing could be traced to the evil of working the engine with the lever in the center notch too soon after starting.

A certain build of engines were put on a certain road to do passenger work; some of the men running them said they were no good, I happened to ride a few miles on one of these engines; she was run on the extreme center notch and full throttle principle; she would just get a good swing on the train, when it was time to whistle for the next station; there was a first-class engine with cylinders 18x28 doing bad work by bad handling; patent valve gear, extension front, sight-feed lubricators and all modern improvements—everything to insure good work, but the engine was choked down in the early part of her run, and then condemned, because she did not furnish the engineer with brains. Show me a man who is always packing valve stems and piston rods, and nine times out of ten I will show you a man who runs on the center notch and full throttle principle. A great many firemen learn this from their engineer, and keep right along in the old rut. I must not be understood as claiming that it is a universal practice; happily it is not.

W. de Sanno.

Tulare, Cal.

In Favor of Full Throttle.

Editor The Locomotive Engineer:

John Alexander's letter, in the April number, was a disappointment to me, although I am only a fireman, and am not supposed to have any opinions.

Now, I do not wish to be impertinent, but, thanks to Mr. Sinclair and Mr. Forney, and the growing number of men who carry their theories into such successful practice, we firemen are beginning to look with disgust at the man who throttles his steam, because we know it means work.

Every one knows that there is a class of engines—which, luckily, are disappearing—that cannot be worked full throttle. Such a class are those engines of former days—the little engines with small boilers, small nozzles and steam ports. But take the modern locomotive with its 50-inch boiler, 4½-inch single nozzle and large steam ports, and I think many older men will agree with me that full throttle is the best.

Let me give an instance. Probably the best freight runner on a certain railroad was an engineer we will call Will. I fired for him once for a short while, and learned why. The freight engines were eight wheel, 17-inch cylinders. Over a 60 mile division our summer trains were 36 loads of bulk and 40 loads of merchandise freight. There are two water tanks, the last being 15 miles from the end of division. During the time I fired for him he never stopped at the second tank for water, and never was the coal-gate taken out going north (we burned slack coming south). His was the only engine that did it, as a usual thing.

How did he do it?

After the first few exhausts, the engine was cut back to half stroke, full throttle; in a train length to ¼ stroke, and after that, where possible, to 6-inch cut-off. When he wanted to kill time, back she went to 4-inch, and only when the engine was doing more work than was necessary there, did he partly shut off the throttle. He rarely carried more than three scant gauges of water, and this to me seems to be the secret of the expansive use of steam—the use of dry steam.

This man could work injectors where others could not, because he had read their description and understood their principle. Although one of the youngest engineers, he was chosen to run as through passenger runner, because, as the superintendent said, "He has never failed to do what we have told him to do."

I never noticed that his engine rode harder than others worked differently, and I generally had steam. When we came to a side-track he would shut off his guide-cups. As a result of this and other care, he ran 120 miles to 4 pints of engine oil when 8 pints were allowed. His engine never ran hot, and he never stole any oil to do it with.

On this same division, within the past year, four firemen have been promoted. Two are doing good work and two are on extra list. The first two are full throttle men, and the last two are not. Another runner on this same road won't work his engine "high up," because it might wear the valves "spoon-shaped."

When I began to fire for our friend Will, I was a beginner. I thought all that was necessary was plenty of smoke. I soon learned that smoke was an abomination to him, and so also was "popping." I saw the reasonableness of it, and tried to prevent them, succeeding in the end pretty well. But I have since learned that a fireman cannot do this unaided.

I do not deny that some of the most successful runners on many roads are men with John Alexander's ideas, but take runs where you have to scheme for water and coal as well as to make fast time, I am skeptical as to their ability to compare with my man. When railroad officials want a fast run made, they rarely figure on the capacity of the tank, or the distance between water tanks. They expect the engineer to do that.

I will add that "Will" is a constant reader of your paper, as well as myself.

Grant.

Dayton, Ohio.

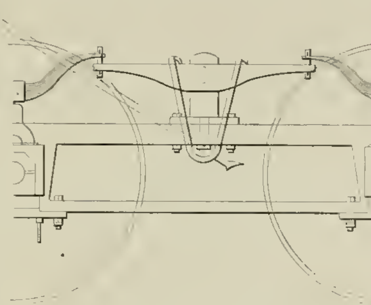
Kink for Removing Driving Springs.

Editor The Locomotive Engineer:

Enclosed please find sketch of an old spring kink. This, no doubt, will be very old to most of roundhouse men. But it will be a cheap and handy tool to those who have not used it. It consists of two hooks, being turned on a piece of 1¼" round or square iron. It should be 18' long, and spread wide enough at top to straddle the equalizer stand. It can be used to strain down equalizer to get gib out. The old spring once out, the new one put in position, the rigging coupled up, apply one or two bars, and come down on them. If men are not plentiful, lengthen out lever indefinitely by putting a pipe on bar. A spring can be replaced in a few minutes. The higher engine is raised on the jacks, the easier the job. This cheap tool could be carried on 8-wheel engines to be used on road. It costs nothing, and is always ready. The only trouble will be to keep one, as they will walk off after engineers see how handy they are, especially old-time men, who run before the spring companies made springs that cannot be broken, and such springs as are now under the majority of 8-wheel engines.

A. T. Hooker,
Gen'l Fm. E. T., V. & G.

Chattanooga, Tenn.



Spring Removing Kink

Where They Make Slide Valves.

During a recent visit to Troy, the writer called at the shops of the Estate of F. W. Richardson, where a specialty is made of building locomotive slide valves with Richardson's balancing device, plain valves as well as Allen valves being built.

These shops have recently been enlarged by the addition of a large two-story building; part of the lower floor is occupied by the Ross Valve Company, builders of pressure regulators and water motors, and the upper floor is occupied by the machine tools, some ten planers, boiler, engine, half a dozen lathes, drill presses, etc. A very ingenious device is used to keep the floor level, on top of the supporting pillars, under the central floor girder, is a heavy wrought screw, working in a cast cap on top of posts, this allows of the leveling up of the floors as they settle.

Almost every road of any size in the country uses balanced valves, and there are more Richardson and Allen-Richardson balanced valves in use than all other kinds combined. Many roads make their own valves under a royalty, but most of them buy the valves and plates ready for service, especially on new work. These works have a capacity of ninety sets of valves per month, and often make that many.

Here also they have a big trade in high grade coil springs, especially adapted for safety valve work, being of a very uniform size and strength, guaranteed to give a certain amount of resistance for a corresponding amount of pressure as well six months after use as upon first trial. In the spring department they were making some very heavy springs, to withstand a pressure of six tons for ½ of an inch compression. All the springs used by the Consolidated Safety Valve Co. are made here.

Mr. H. G. Hammett, the manager of these works, is a live man, and a planer that can't carry an honest cut at 20 to 22 feet per minute, and get back at the rate of 50 or 60, is set one side for one that can.

Foreigners at Baldwin's.

The Baldwin Locomotive Works are completing 30 locomotives for South America. There are 12 saddle-tank, six-wheel connected switching engines for the provincial government of Buenos Ayres. They have outside connected driving brakes, on the English plan, iron cabs, copper fire-boxes, and a peculiar excuse for lagging, one-inch angle irons are placed around the boiler like hoops, and a jacket of $\frac{1}{16}$ iron is placed over them, no non-conducting material being used.

There are also several freight and passenger engines for the Argentine Republic. After being put up and tested, these locomotives are all taken apart and carefully boxed. In the shop we noticed a very small engine for Cuba; one narrow gauge, domeless coal mine engine with Wootton fire-box, several little street motors, and the usual dozen or so of ordinary engines for our own roads.

The N. P. are fitting two engines with the Smith feed water purifier.

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CONTENTS.

A Useless Expense in Locomotive Building.

Half the master mechanics in the country—yes, two-thirds of them—express their opinions pretty often of the inability of engineers in general to appreciate or fairly understand the "improvements" constantly being applied to their locomotives. When a runner wants any little change made on his locomotive for his or his fireman's comfort or convenience, they say he is a crank and don't know what he does want, and if let alone would spoil the "standard" of the locomotives, and make them cost twice the contract price, before they were contented. Sometimes the M M. is right. However, people who live in glass houses should not throw stones.

The slight departures from general design in ordering locomotives, made by the majority of master mechanics to meet ideas of their own, has raised the cost price of locomotives from 15 to 25 per cent., and the cost of repairs to several times that amount. This statement we do not believe can be successfully refuted. When a man makes radical changes to meet the requirements of the peculiar service of his road, that is necessity, and there is an excuse for it; but when a man furnishes drawings for all the parts of his locomotives, and insists on their being built to them so close that he won't accept a cylinder casting of the works' standard pattern, because there is a fillet in some angle where he has none, he is going to lots of expense for nonsense. Any locomotive works in the country will bear evidence that it is necessary to make new cylinder patterns for almost every order they receive. If the order is for one engine, the entire expense of the pattern must be added to the price; if for a hundred, the price is proportionately less per engine.

What is true of cylinder castings is true of most of the other standard parts.

If the Master Mechanics' Association, or an association of builders, would determine the best average proportion, weight, size and material of such parts of standard engines as cylinders, wheel centers, frames, valve motion, axles, boxes, etc., and buyers would order to these standards, the roads would secure cheaper and better engines in much less time, and the repairs would cost far less at home and on other roads.

For instance, if the proper size and weight of a cylinder for a 17x24-inch engine was decided and agreed upon for all 8 wheeled locomotives of that size, every works in the country would build, finish and keep in stock cylinders ready to be used at a moment's notice; so they would frames, wheel centers, axles, pins, rods, etc., and so they might boilers, but the great difference in fuel and water makes changes in this line more excusable than in the running gear.

If builders could keep in stock standard parts for two or three sizes of the different types of locomotives, the parts could be made for stock in slack times, and not under pressure for hurried orders. They would be made in quantities, and consequently cheaper; more time being taken and better and more thoroughly understood drawings being used, a better class of work would result.

If an order came in for locomotives calling for standard parts, the work would be half accomplished by assembling the parts, where now the first week or ten days is lost in the pattern shop.

The standards already established by the master mechanics are, we believe, counted as good ones, and most of the members of the association seem to agree that they are all right—except when they order new locomotives, when they try something of their own.

Railroad companies are combating the public demand for power brakes, automatic couplers, and steam-heated cars on the ground of expense; but there seems to be no attempt to reduce the first cost and running expense of locomotives by a systematic adoption of standard sizes—to reduce the outlay in the motive power department, it is considered necessary to discharge shop men or reduce wages.

Promoting Mechanics.

At the Altoona shops of the Pennsylvania road they have what are called "special apprentices"; these are young men who have graduated from some technical school, and are then taken into the service. They are worked in different departments of the shops for a short time, and then placed in the test department; here an elaborate system of testing all material used in construction is conducted; wood, iron and steel are tested for strength, etc., chemical tests are made, men go from this department to indicate engines, make dynamometer tests in locomotive trials, etc.; and when the Pennsylvania Railway are in need of a foreman, a superintendent, or any other officer, the "specials" get the preference for promotion.

A representative of this paper recently met a young man who occupied a prominent position on another road, and was told by him that he was raised on the Pennsylvania, studied his business, and made enough show with his work to attract the attention of the officers of another road; he was offered a higher position and higher pay, but, hoping to stay at home and finally receive promotion there, he brought the matter to the attention of his superior officers. He was told that his work had been well done and was appreciated, but that, as he had no technical education, he could not hope to be advanced any further than the position he had already reached.

Of course, under these conditions, any ambitious man would resign and seek more appreciative employers. This young man took service on another line, and has since been promoted to the general supervision of his department. By any arrangement of this kind the Penna. is the loser and the other road the gainer.

The promotion of railway men for the management of the motive power, transportation on maintenance of way, should be made from the rank and file, just as cream is secured from milk—by taking what comes to the top.

The older and most successful officers of the P. R R were not graduates from technical schools, yet they were and are the best of men for their places. They came from the ranks.

The fact that a man who has the natural qualifications and the practical experience is a graduate of a technical school, would rather tend to his benefit and success than otherwise; but the man with the education and without those other and necessary qualifications, stands a poor show of success.

The trouble is that men who wait to get the education before they learn their trade, seldom learn the trade thoroughly enough to deserve and receive journeymen's pay away from their home road, and those who have to scheme hard to make both ends meet financially, while learning their trade, do not have the time or money to get the technical education.

A combination of both qualifications is desirable, but we do not believe it of any use to preach to the shop boys of the country the necessity of going to a technical school after they have learned their trade. Few will be able to do so, for financial reasons.

What they want to do is to get all the education they can in their line, while learning their trade. With one, and not the other, the practical mechanic has the best chance of success in railroad work.

Relief Associations.

One of our correspondents asks our opinion of the benefits of relief associations as established on the B. & O., Reading, and the Q., and we are in receipt of several private letters asking the same question. We will let this reply to all

As relief associations are now conducted, we believe that they are a good thing for and a relief to the companies, but not to the men.

The general plan is to establish hospitals, hire doctors, and formulate some sort of a sliding scale for benefits in case of accident or death, and, perhaps, a fund for superannuated members. These expenses are met by reserving a stipulated amount out of the pay of all employes, sometimes so much per month for all, and sometimes in proportion to the pay received. These funds are placed in the hands of an officer appointed by the company; and, in some cases, the company pay into the treasury a certain per cent. on the tithings assessed on the employes.

The idea is held out that these institutions make the men more contented and insure them employment, which is just as true as the statement that the moon is made of cheese. We do not know of a single association or fund of this kind that is not controlled entirely by the company. We do not know of one where the men have any voice whatever in the management of the fund, where they elect officers, physicians, or even receive a statement of the receipts and disbursements of the funds they have paid in. On most roads membership is compulsory, and on those where the men join "of their own free will and accord," men are given to understand in more ways than one that it would be better for them if they did belong.

The main idea in the establishment of relief associations is to secure the company against labor troubles, keep the employe where he is wanted, and make money out of the whole scheme.

Men are no more secure in their positions where a one-sided relief association is assessing them monthly, than on a road where they have to relieve themselves. Charles Francis Adams proposes, among a lot of impracticable things, some very good ones, the best of which is the taking out of the hands of petty officials the power of discharge, and giving the employe the benefit of a trial—the right of appeal. This rule should be established on all roads, whether they have relief associations or not.

It is human nature for men to want to conduct their own business, and it is right that they should. All railroad men should be insured, but they should be able to insure when, where and how they please.

If these associations were so conducted that those who pay the expenses could have a voice in the selection of officers and the disbursement of funds, it would not be so bad.

The legislature of Maryland has annulled the charter of the B & O. Relief Association, because it was unconstitutional.

Scheming officials think, and recent developments on the Reading prove, that if they can make the relief insurance high enough, and the assessments hard enough, and membership compulsory, that men will draw out of the Brotherhoods and mutual insurance in their own orders. The insurance of the B. L. E. and B. L. F. are the only ones where a man gets his insurance in case of disability from any cause, and is, therefore, worth more to railroad men than other insurance; we would urge them to keep it up. This paper described a plan of relief, (July, '88), and gave the full text of the by-laws whereby employes can secure the services of their own physician, and pay for them, and providing a burial fund in case of death, by this plan the members elect their own officers, and receive the benefit of every cent paid in, and are furnished with a statement of accounts every year.

Where relief associations are not too expensive, are not compulsory, do not make it necessary for men to withdraw from any order, let them employ their own family physician at the expense of the association, instead of the contract doctor, let them have a voice in the management, and pay back, in case of dismissal, a certain per cent. of what they have paid in (unless they have had more than the amount in benefits) they are good, and we would advise joining them, where they call for the surrender of one single atom of independence or manhood, we would advise against them.

The manner in which they are conducted is enough to condemn them. This paternal business is not what is wanted on American railroads; the way to secure the best men, keep them in the service and prevent strikes is to treat them fairly, require the best service, and pay such wages that the men will be enabled to care for themselves and families, and have no desire to seek other less remunerative and less desirable occupations.

The *Railway Age* evolves the following.

"By far the largest share of the earnings of railways goes directly to labor, the capital invested getting but a very small per cent. No class is so deeply interested in having the railways receive fair wages for transportation as the great army of their employes."

The great army of railway employes are interested in having the roads get fair prices for transportation; but the army will always wonder why the poorly-paid capitalist does not haul in his securities, sell his private car, and enlist in the army of favored and affluent autocrats who tamp ties and run trains.

ASKED & ANSWERED.

(17) H. H. H asks:

What are the best remedies for cutting of guides and crossheads? *A.*—Line up carefully, and tin the gibs or crosshead.

(18) "Inquiry," Kingston, Can., asks:

Could you give me a process for welding steel locomotive flues? *A.*—As far as we know, steel tubes are not harder to weld than good iron ones, and the process is the same

(19) Student, Stuart, Iowa, asks

In case of a broken rocker arm, does it make any difference which end of guides you block the crosshead at? *A.* If an engine has a driver behind the guides, it is often necessary to block the crosshead where the pin cannot strike the key or other parts It is always better to block at the back end, as, in case the piston should get steam on it, and get away, it would be cheaper for it to break the front head than the back with the guide connections, etc

(20) B. F. M., Ft. Snelling, Minn., asks.

1. How many roads have adopted the standard signal code? 2. What do you think of the benefits, to the men, of relief associations as established by the Reading and the Burlington? 3 How is water taken "on the run"? *A.*—1. We do not know; being adopted slowly 2. See editorial headed Relief Associations 3. A shallow trough of iron is located in the center of the track on a level district, trough is about 4 inches deep, 15 wide, and from one-half to one and a half miles in length; this is supplied with water from an ordinary tank; the tender of the locomotive is provided with a large iron spout about 6x12 inches internal measurement; this spout is shaped something like a comma (,) the point terminating in a cast mouth, reaching to within a few inches of the track, and located in center of tank between the trucks; this point is jointed and is raised up out of the way by a system of levers controlled by a handle on the tank On approaching a tank, speed is reduced to 20 or 25 miles per hour, and the fireman drops the spout, or scoop, and the force of the train drives the water up through the spout and empties it into the tank through the upper end.

IN THE ROUNDHOUSE AND Repair Shop.

The Schenectady Locomotive Works.

Next to Baldwin's, the Schenectady Locomotive Works are the largest in the country. The works occupy quite a tract of land, and the buildings, which are of brick, are large and of modern construction; the blacksmith shop, boiler shop and office have been doubled in size and the machinery all rearranged within the past year, and this without losing an engine.

Supt. Pitkin is one of the few successful superintendents of locomotive works, and has able lieutenants in Assistant Supt. White and Chief Draftsman Lane.

Mr White has immediate charge of the machine department, and showed the writer through the shops, which are equipped and the work handled in altogether a different manner than we have ever seen at other locomotive works. The first thing that catches the eye of a mechanic is the big chips rolled up on the milling machines in the fitting shop. Mills are used for many purposes, especially on brass and wrought iron.

Milling machines of almost every pattern are used, one man runs two universal millers and does all the work on rod brasses, finishing them complete and in a very thorough and workmanlike manner. It was found that, with ordinary spiral mills, in cutting out the sides and bottom of the space for strap, that the thrust of the tool and strength of the material would stick the machines with anything like a heavy cut. This has been overcome by a change in the construction of the cutters These large cutters are divided in the middle, and fit together in the shape of a spiral clutch, so that when the end teeth are ground the two pieces can be packed apart and the exact length maintained; by this construction one clutch jaw drives the other and makes the tool practically one piece. The thrust of the tool caused by the spiral cut of the teeth was overcome by cutting a coarse thread right through the face of the teeth in an opposite direction from the spiral; this makes a series of smaller teeth, and cuts the brass chips up into short pieces instead of long, heavy ones, braced at both ends against the sides. The uses to which milling tools are put are almost endless. Mr. White found great difficulty in using long mills of moderate diameter in heavy wrought-iron work, caused by the constant breaking of the teeth. They have very little trouble now, and have cured the breaking by slightly drawing the temper of the mill by placing a red-hot iron in the arbor hole after tempering.

Very little attention is paid to the forming of parts in the blacksmith shop; they simply take pieces of iron and cut out locomotive parts with machine tools, and claim they can finish the parts ready for use for less than elaborate blacksmithing costs. All such parts as eccentric blade forks, link hangers, guide blocks, links, etc., are simply cut out of chunks of iron, with little shape to them

We have never seen wrought-iron cut and handled as it is here, milling machines and slotters taking most of the work, but many planers getting there with big cuts Every machine that cuts wrought-iron is provided with a pump and a stream of water, suds or oil runs on every tool. Almost all of the machines have had new tables put on them with arrangements to carry all the drip back to the pump tank

Solid-ended rods come from the hammer shop without much shape to them, and the bosses around pins are formed in a slotter, and the bushing hole bored out on a mill in very short order. These holes are cut through with a tool that simply bores around the outside, leaving a core blank, those from large rods are made into pin collars for smaller rods; the sides of rods are finished at a single cut in a milling machine. Any mechanic who is disposed to believe that lathes and planers can be made to compete economically with modern milling machines and slotters should visit this shop

They grind up such surfaces as the tops and sides of guides, guide yokes, link hangers, links, etc., with emery wheels, and have a wheel for this purpose rigged upon a planer bed for guide work Solid emery wheels running dry will get hot, and get work hot, and have to be dressed very often to keep them true enough for guide work. Here they use an iron wheel with a light rim, not more than one-half inch thick, on a wheel 12 inches in diameter and four-inch face. This iron wheel has a square thread cut in its face, about four threads to the inch, and then the face of wheel is cut across the threads with same sized tool, leaving the face covered with little projections of iron about ¼ of an inch square. These wheels are coated with glue and rolled in emery until the coating is about ¼ of an inch thick on the face, and are found to run cool and cut better than solid wheels, they last from 10 to 40 hours without re-coating. Very small wheels of this construction are used to grind out hardened work, such as the holes in link blocks, hangers, links, and eccentric blade forks. It is difficult to run wheels as small as an inch or an inch and a quarter fast enough to do good work, and this trouble is cured by centering the work on a lathe and running it at fastest speed in one direction, while the wheel is run on an arbor held in a frame on tool post, and run in an opposite direction by an independent belt to a drum over the lathe, this allows the wheel to be handled on the lathe carriage, just as a tool would be, and case-hardened or tempered work is ground very fast and very accurately.

Such pieces as steel pins for motion work with a bearing surface in the center and taper fits at both ends are ground on a machine for that purpose.

A great many small duplicate pieces of iron or steel are made on a new turret lathe for such work, and solid screw cutting machines do the work of thread-cutting formerly done on lathes A new heavy screw cutter was making locomotive jack screws, three inches in diameter, and cutting the thread in good shape about as fast and as noiselessly as an ordinary bolt cutter would cut a thread on a half-inch bolt. This machine, in the hands of a laboring man, threads and finishes the screws and taps the standard on thirty jacks in four days.

The forge shop is ventilated and cleared of smoke by two large exhaust fans, and much of the work is done by bulldozers and heavy punches. They weld frames in a new way that would seem to insure good work, a jaw is not welded to the frame proper, but a piece is drawn down from the frame and the weld made in the jaw itself. This and the frame pieces are scarfed in V shape in the direction of the length of frame, and a weld made; the frame is then returned to the fire and a welding heat made, when a small strip of metal is laid on the jaw and welded down and the same operation repeated on the other side. This makes three welding heats to each weld, with an introduction of new metal at each heat, that ought to insure all their frames against breaks in the welds.

In the boiler shop, steam riveters, punches and shears are on every hand. We noticed that all trimming shears used on tank work, etc., not only cut the strip off the edge of the sheet, but cut the strip up into short pieces at the same time, making them easy to handle and keep out of the way.

A new electric light plant has been added to the works, and an incandescent lamp with a wire guard hangs over every tool.

On every hand new tools are to be seen, some not yet belted up; no old tools are to be seen in operation, and one reason for the success and reputation of these works can no doubt be traced to this rule of the able superintendent in charge, to have every new tool that could produce work quicker, or cheaper, or better than the ones in the shop. These works turn out an average of one locomotive a day, and as each man on a tool does one kind of work continuously, no elaborate system of keeping tools in the tool room is maintained. Men in the tool room grind and repair the tools, and keep extras in stock, but when they are issued to a man in charge of a machine, he keeps them as long as they are in condition for service. In the erecting shop they are getting one of the Strong boilers up, ready to assemble the work on her, pieces of which are to be seen all through the shops.

They have just turned out a heavy passenger locomotive for the C. M. & St. P. R'y. This engine has six wheels connected, a double truck in front, and a pony truck under the fire-box. She has cylinders 19x24, with ports 18x1$\frac{5}{8}$, exhaust 18x3, Allen-Richardson valves, drivers 69 inches diameter, truck wheels 30. Weight on drivers, 85,000 pounds; on trucks, 48,000. Rigid wheel base, 12' 6'', total wheel base, 27' 10''.

The boiler is a wagon top, is 56 inches in diameter at the smallest ring, has a fire-box 102x42$\frac{1}{4}$ inches, 247 flues 2" diameter and 12' 6'' long; steam pressure, 165. The engine is provided with the American outside equalized brake to be operated by air, and uses the Ross-Meham brake shoe.

This engine, which was designed for fast, heavy trains between Chicago and Milwaukee, was tried for several days on the N. Y. Central, and found to work satisfactorily.

In the back shop they are building a large 12-wheeler (8 wheels connected and a double truck) for the Beach Creek road, five 6-wheeled switches for the Long Island, two 19x24 8-wheel passenger engines for the C. & O., six 20x24 consolidations, and a large 6-wheel switcher for the Duluth and Iron Range; two 18x24 10-wheelers for the Fairhaven & Southern, nine 19x24 moguls, and five 19x24 10-wheel passengers for the L. S. & M. S.

In the drawing room the card system of shop drawings is used, much the same as at Baldwin's. But Chief Draftsman Lane has a very complete system of record books of his own design. All drawings are duplicated in books and preserved in vaults. Many of the processes of manufacture at these shops are extremely interesting, and will be treated separately at another time.

We are under obligations to Clement E. Stretton, C. E., for a copy of a plate representing 30 locomotives built by Robert Stephenson & Co., Newcastle-on-Tyne, commencing with "Locomotion," 1825, and showing the various evolutions in English locomotive practice, up to 1887. The plate will be useful in our collection of historical locomotives.

President Setchel, of the M. M.'s Association, has accepted a position as agent with the Pittsburgh Locomotive Works.

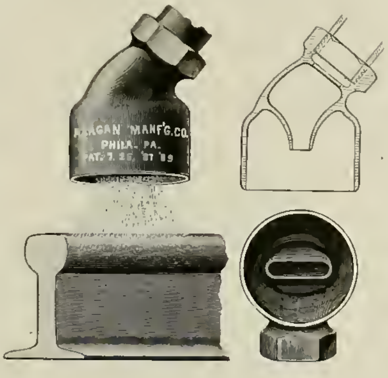
The 24-Hour System.

The 24-o'clock system of computing time is slowly gaining ground, and is a safeguard against mistakes in time cards that must sooner or later be adopted. It has been in successful operation on the Intercolonial of Canada for two years, and on the Western divisions of the Canadian Pacific for more than three years, and the system will soon be extended over the entire line.

A committee on standard time recently reported to the American Society of Civil Engineers, that, of ninety-nine replies received from railway officers, sixty-one were in favor of the 24-hour system, thirty-eight were not in favor of the system, but twenty-four of them would adopt it if connecting lines did.

The principal objection to the 24-hour system of computing time is the prejudice against a change.

Division No. 1, Brotherhood of Locomotive Wipers, has been organized, with twenty charter members, at Newton, Kan. We are in receipt of a very handsome invitation to their first annual ball, which was given April 25th; the usual silk ribbon on the invitation is replaced by a piece of waste. There is no good reason why the boys who groom the iron "hoss" should not be organized, as well as those who ride.



Anti-Clogging Sand Pipes.

On this page will be found cuts of a new anti-clogging tip for locomotive sand pipes, being placed on the market by the Reagan Manf'g Co., of Philadelphia, Pa.

All runners know that the movement of the locomotive over the track produces a partial vacuum at the end of the sand pipes, causing them to gather moisture, and the first attempt to feed sand through them coats the interior of pipe with a stiff coating of wet sand, and all know that in damp weather it is a regular job to pound sand pipes—there are monkey wrench marks on 40,000 sand pipes to prove this.

The device shown has an enlarged cup that gathers all the moisture, while the sand jet is located in the center of this cup, and high enough in the pipe to avoid the suction; the sand opening is in the shape of slot, and crosses the rail, thus being sure to get sand where it is needed, on curves and over frogs.

The opening being small and the pipe large, a man can fill the pipe and it will feed a small quantity for some time, without further churning of the sand lever. This device is in use on the Pennsylvania R'y.

Angus Sinclair recently delivered a lecture on the compound locomotive, before the New England Railway Club, at Boston. Mr. Sinclair believes in the efficiency of compound locomotives, but not in the forms now in use.

Air-Brake Practice.

By J. E. Phelan.

TWELFTH PAPER.

In following up the principle of action of the engineer's brake and equalizing discharge valve in mountain service, it practically stands in same relation to train appliances in principle as former engineer's brake valve.

It is when connected in double heading service on mountain grades, or other grades, for that matter, that we note difference worthy of statement.

As this equipment has been furnished on new engines by certain locomotive works, this feature in double heading service has been very prominent, and as many engines are now in service in this condition, remarks may be of value.

For leading engine, handling air, the valve is all right. For the assisting or helper engine, there is need of care and discretion to avoid interfering with pressure of leading engine. The simple remedy, no doubt, has been to let the engine next the train do the braking; but such practice often proves disastrous.

The Locomotive Engineer, in issue of April, 1889, gives in Air-brake Practice notes of difference in detail between engineer's brake valve and engineer's brake and equalizing discharge valve.

As engines have been equipped, the pump governor connects directly with main air pipe—economy with the piping apparently being main object in view. Main reservoir is connected directly with indicator of air gauge (see paper No. 3, The Locomotive Engineer for July, 1888). The latter as it should be. The train pipe indicator connects with chamber and auxiliary of valve body.

When engineer's brake and equalizing discharge valve is blanked or on lap, the rotary valve closes all ports, and air from main reservoir flows in on top of rotary valve and there stops, awaiting an outlet.

It follows that while in this position the chamber and auxiliary of engineer's brake and equalizing discharge valve are cut off from main reservoir and train pipe as well, and pressure in chamber lies dormant, and naturally less than that existing in either train pipe or main reservoir so long as valve is blanked.

You will notice in double heading with valve in blanked position when pump governor connected to the train pipe, your main reservoir pressure on helper engine indicates what the pump governor permits on train pipe—your train pipe indicator connected with chamber indicates a dormant and uncertain pressure, as noted before.

Your train pipe being supplied by leading engine, your pump and governor come under control of the leading engine wholly.

We will not state remedy until we go into conditions more fully.

It can be noted with former engineer's brake valve, having its various valves controlled and held in place by springs, that when in blank position, its feed valve is completely cut out of service.

The main valve held to its seat, with ports blanked, by the main valve spring and pressure from main reservoir.

The top valve, when in blank position, by having had handle controlling it moved to right, and raising handle screw controlling this valve and its spring, has made the spring less contracted; yet the spring's tension ought to be sufficient to hold top valve to its seat, in resistance of pressure bearing on it from train pipe while in such position.

Hence air from source of supply on leading engine simply passes through the air pipes of helper engine, same as though helper engine not equipped with air pump, etc. Air braking up in pipe connecting with engineer's brake valve simply fills in blind space, without affecting source of supply on helper engine, excepting as governor may be controlled by leading engine. But the pressure thrown into pipes by leading engine in recharging or releasing brakes, can have no escape, if top valve spring in good order, except by flowing into proper channels and recharging train appliances.

Air gauge connection with train pipe is always made with train pipe through an indirect and small opening, and in our service pump governors are connected with *air gauge pipe*, connecting with train pipe. In this way the action of leading engine's air supply is not so abrupt in acting on governor as it would be if directly connected to train pipe by ¾" pipe.

This condition of affairs allows helping engines to keep up about maximum pressure in main reservoir, ready for use at any time if called on to assist leading engine in recharging train, or taking full charge of train in event of leading engine's supply of air, or means of supply failing. In such event the engineers in charge simply alter conditions by transferring control from one to the other.

You will note in engineer's brake and equalizing discharge valve there are no springs controlling valves excepting one controlling feed valve. This, as in former engineer's valve, is out of service when in blanked position.

As noted in previous paper, train pipe connects at base of valve body, reversing matters in this particular compared with former engineer's brake valve.

Summing the matter up in as few words as possible, in order to insure the engineer's brake and equalizing discharge valve being as passive when in blanked position, and in use on helper engine, it will be necessary to gain and keep in main reservoir to bear on rotary valve an equal or greater pressure than that which may be transmitted through main pipes by leading engine in recharging or releasing train brakes.

It may be a comparatively easy matter to hold rotary valve to its seat.

Let us now return to the point where we digressed.

While rotary valve is held to its seat by active pressure from main reservoir, the piston valve is held to its seat simply by the dormant pressure in chamber and auxiliary of valve body.

Hence, when pressure backs up train pipe and strikes under this piston valve, pressure meets but little resistance, and unseating piston valve there is a waste of air into atmosphere through exhaust port for service stop.

Here is where the stop-cock in service stop exhaust port can be used to advantage by closing it while in such service.

It is our belief that the pump governor should be connected to the air gauge pipe leading to chamber, and thence connecting with train pipe pressure. This secures it from abrupt influence from pressure of leading engine.

You will note the dormant pressure, however, would remain in the chamber, and pump of helper engine could gain pressure in excess of that handled by leading engine, and so long as remaining in blanked position, the rotary valve could be held to its seat, but, without the stop-cock in service stop exhaust port, the piston valve would be the weak point for waste of pressure, in hazardous mountain service.

In absence of stop-cock, in service stop exhaust, the piston valve can be controlled and held to its seat by following plan, stated in April LOCOMOTIVE ENGINEER, for reseating it, *i. e.*, pushing handle to left, so that handle spring may rest midway between lap and position while running. In this position equalizing port is put in communication with train pipe.

To avoid confusion and insure most effective work, we believe it advisable to connect pump governors with *air gauge pipe* leading to train pipe, and put on a stop-cock in train pipe, in convenient place just below base of valve body. Then, when in helper service, or double heading as helper engine, you can simply turn the stop-cock and carry your engineer's valve in feed position, and hold maximum pressure plus 20 pounds more or less reserve in main reservoir for emergency.

The Baldwin Locomotive Works have built somewhere in the neighborhood of 100 locomotives, with the form of boiler designed by N. W. Sample, superintendent machinery of the D. & R. G. road. The wagon-top is extended far enough ahead of the fire-box to place the dome over the flues, thus allowing the use of radial stays in place of crown bars in boilers with wagon-tops.

The West Albany Shops of the N. Y. Central Railway.

These shops are the largest railroad shops in New York State, and do almost all the locomotive repairing for the N. Y. C. & H. R., as well as the West Shore roads; they also build most of the cars here for the great four-tracked system.

The shops are on the west side of the river, and some three miles from the city, occupying a large tract of land and a small village of buildings; yet they are crowded for room.

The engine and boiler house occupy a central position among the buildings, and the power is supplied by two different engines. An old-fashioned condensing, beam engine originally supplied all the power, but many years ago was relieved of the burden of the machine shop and given the woodworking machinery alone, while a slow-moving horizontal was placed beside her, to turn the shafts in the iron shop. These engines, and the room in which they are located, are kept scrupulously clean, as, indeed, the whole shops are.

The machine shop is a very large building, with one central line shaft running the entire length, and the machine tools arranged on either side. All the machines are painted a wine color and striped with red, and, being kept clean, look like an army in uniform.

There are a good many old tools there, but the great majority of them are only middle aged, and some are new. In the back shop, or pit shop, the pits are not so close together as is usual, and a machine tool is located between most of the pits, a lathe, a drill press, or a forge located thus saves lots of running where work is done on the cut and try plan, as is almost necessary in repairing old work.

The Central still build most of their engines with independent cylinders bolted to a central casting, but having all the exhaust and steam passages cast into the cylinder castings, the central piece being simply a support.

They make their eccentric castings with a heavy collar on the sides that carries the set screws, making them easy to get at, and also giving a large bearing surface on the axle and the key.

Extension fronts are covered with a piece of sheet iron held away from front enough to make an air space, and then are covered with Russia iron, making a neat front.

The new consolidation engines are very heavy, provided with American driver brakes, and having flanges on both the forward and rear drivers, making a very long, rigid wheel base, we noticed several badly cut flanges.

They are putting in a new turn-table, and fixing up the roundhouse so as to take in these modern freighters.

We noticed in the supply house extra main rods for consolidation engines. These rods have a solid front end with solid brass bush. Mr. Buchanan, M. M. in charge, says they run about ten months without any trouble.

None so Blind as Those who will not See

The *Journal of Railway Appliances* "talks back," and says that it only took four lines out of this paper in January, and this was just repeated out of an old scrap book of theirs, and were chestnuts any way. If the good little editor will look back to his January number he will find that he made a couple of headed articles out of our account of the piece-work system at Renovo shops, lifted bodily the article on Manual Training Schools, and citing the Spring Garden Institute, Philadelphia, and stole a 7-line item out of the center of a correspondent's letter on Driving Brakes.

They must like "chestnuts."

The Ross Valve Co. have recently perfected their pressure-reducing valve, so that it will handle steam down to one pound pressure. In the end, instead of having one reducing valve at the engine, our steam-heated cars will have to have a pressure-regulating valve at each car, and the valve that can be regulated the closest will have the best show of success.

Pointers on Setting Up Injectors.

The Rue Manufacturing Co., Philadelphia, Pa., have got out a new catalogue of their injectors, ejectors, boiler washers, testers and general jet apparatus. The "Little Giant" is one of the best known injectors in the market, and without exception the easiest repaired and cleaned. Under the head of General Instructions, they give a few fundamental rules for putting up injectors of all kinds, that, if heeded, would save lots of trouble, and stop some of the *mysterious* agencies that go to make injectors cranky; the following are a few samples.

"When attaching injectors, the pipes should be short and straight as possible, internal diameters must never be less than the fittings on the injectors, and if over ten feet in length, they should be at *least* one size larger. Steam to be taken from highest point in boiler.

"When the pipes are ready for the injector, they should be thoroughly cleaned out by allowing steam and water to flow through before coupling the injector to them.

"The water pipe should be provided with a screen with holes of less diameter than the smallest part of the injector, and sufficient number to allow plenty of water to pass through when the larger part of them are clogged up, which is often the case. When water is to be lifted, the *pipes* must be *perfectly* air tight. Lifting injectors will raise water from 5 to 15 feet, according to circumstances. When lifting injectors are used, they should be placed as close to the water as possible. High lifts reduce the capacity of all injectors, also their reliability."

J. E. Lonergan, of Philadelphia, manufacturer of oil-cups, checks, gauges, etc., is building a new factory, beside his present one on Race street. The new building will occupy 44 front by 114 deep. The fourth story will be occupied by the brass foundry, one of the floors by the shops of the Rue Manufacturing Co., and the others by the machine shop, finishing, assembling and storage rooms. It is pleasing to note this evidence of success as a manufacturer, of an old locomotive runner. Mr. Lonergan used to eat cold lunches and take grief on the Central Pacific.

A. Van Guysling, who has been engineer at the West Albany shops of the N. Y. C. & H. R. R'y for the past twenty-four years, has recently patented a reversible oscillating engine of very simple design. He has had several built, and has one, an 8-horse-power, running in his engine room. It occupies a floor space of but 15x15 inches, and requires but 24 inches head room, making the design a desirable one for yachts and to drive machinery in crowded places. The railroad company have recently built a pair of them to operate their big transfer table. This machine works admirably.

The Pond Machine Tool Works, Plainfield, N. J., recently turned out their first driving wheel lathe. It was built to the order of the C. R. I. & P. R'y (Rock Island), and had several departures from the usual styles of this kind of tool. The lathe was extra heavy and large, being 79-inch swing, it was tried in the shop and proved all that the designers or the buyers desired.

The employes of the Westinghouse Air Brake Works went to work at reduced hours on April 8th, in order to keep all the men employed.—*Railway World.*

The largest electrical conductor in the world is now being put down along the tracks of the Ninth avenue elevated road in this city, by the Daft Electric Co.

It is stated that wire ropes can be kept from rusting by using oil, thickened with graphite, much better than by the use of paints or tar.

The Grand Trunk has recently put in several Gentry & O'Brien tire heaters at their different shops.

In the East Albany Shops of the B. & A.

At the East Albany shops of the B. & A. road they are very quiet, and the dull time has given them a chance to rig up a little, although, like all railroads, the master mechanic, foremen and men can make all the improvements they are a mind to, provided they are all evolved from the scrap heap, and cost the company no money.

At this shop, Master Mechanic Purvis and his son, who is general foreman, are ingenious men, but they are like lots more of the same kind—hobbled.

The large consolidation engines have broken a great many rods, mostly at front end of main rod, caused by a strap end, the key being inserted from underneath, and held by a lug on the end of the only strap bolt; when this bolt breaks, the whole thing is loose and falls off.

These accidents happened so often that a stock of rod straps and back cylinder heads had to be kept on hand; to make these duplicates, templates were fixed up with hardened steel bushes to drill through, and all time and expense of "laying out" work avoided.

They have recently put up a water crane, such as illustrated in THE LOCOMOTIVE ENGINEER in May, 1888, which is used to handle wheels and axles for a hydraulic wheel press.

Modern wheel presses have a large and a small pump, the larger one to handle the ram quickly up to its work, and the smaller one to force in a high pressure. These shops have an old style press with only the small pump, but a pipe connection from the press cylinder directly to the water works' main does the work of a large pump very quickly, by simply moving a valve lever.

This road has in use a great many old engines, built by Mr. Eddy years ago; they are domeless, using a perforated pipe to draw off the supply of steam; they are said to carry water remarkably well. A peculiarity of these engines is their short ports, freight engines having but 10-inch ports.

The present Supt. of Mach., Mr. Underhill, is also a believer in short ports, and has some 17x26 engines running with ten-inch ports, and many large passenger locomotives with ports but 14 inches in length.

These shops are clean; in fact, they don't seem to have enough to do to get them dirty. In the blacksmith shop there are large hexagonal chimneys, built up from the ground, having the fires arranged in openings around them, so that considerable room is given to handle work, as the space in front of each anvil is larger than if the fires were arranged in rows.

The spectacle of a machinist chucking and boring a few car wheels per day in a common lathe, when a $1,000 tool can be bought capable of taking the wheels from the floor, chucking, boring to gauge, facing off the hub and replacing the finished wheel on the floor again at the rate of one in seven minutes, with no other help than an intelligent boy, is not likely to impress a practical mechanic as either modern or economical practice.

The B. & A. shops at Albany, are far from being the owners of or operators of the poorest machine tools in their part of the country, but a wholesale procession of ancient locomotives and antediluvian machine tools from the back shops to the cupolas is a much needed move on almost all the roads in the New England and Eastern States.

The old muly saw-mills of the 18th century can not compete with modern high-speed circular saws in the manufacture of lumber, and locomotives and rolling stock can not be kept up with old chain-feed lathes or wim-wam drill presses with slippery elm frames.

Watch this Prophecy.

Pretty good locomotives used to be built and run with wrought-iron tires, but since the introduction of steel no maker or no road can be found who will use wrought-iron, simply because the steel is safer and better, although it costs more.

We venture the assertion that, in ten years from now, cast-iron car wheels made in the common chill will stand just about the same in comparison with those made in contracting chills, as wrought-iron tires stand with steel. The contracting chill is not an experiment; it actually gets smaller when it gets hot, and hugs the wheel, making a deep, uniform chill, and insuring uniformity in size and rotundity. 60,000-pound cars must have carefully turned steel tired wheels, or else a great deal better and safer cast chilled wheels than can be made by the old process.

CAST STEEL WORKS of FRIED. KRUPP, ESSEN, Germany.

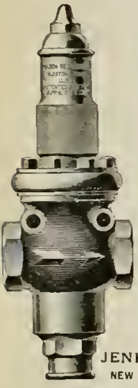
Represented by THOMAS PROSSER & SON, 15 GOLD ST., NEW YORK.

These works cover an area of 1,200 acres, employ about 18,000 men, have the most improved plant, and stand unique, from the fact that they have their own Ore and Coal Mines, Blast Furnaces, etc., and that *every* stage of manufacture is under their own supervision, and are not (like others) dependent on the open market for a miscellaneous assortment of crude material; which, in connection with 75 years' experience, enables them to turn out a product of a very superior quality, second to none, and at the same time the different grades of Steel are always of the *same uniform* quality.

Locomotive Tires, Crank Pins, Piston Rods, Spring Steel, Steel-Tired Wheels, Etc.

After a test of over 25 years the "KRUPP TIRE" has proved itself the best in the market. If a reliable article is wanted, which will give satisfaction, get KRUPP'S.

AIR PUMP REGULATORS



The cut herewith shows our new pump pressure regulator for air brake pumps. During the past nine months we have thoroughly tested them on engines of the Boston & Albany R. R. They have not required a particle of attention during this time. We now guarantee them. As the air pressure chamber is entirely separate from working parts any dirt in train pipe cannot get into working parts. Weight 7 lbs. Sent on trial.

Mason Regulator Co.,

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THE VANCE LIGHTNING FLUE CUTTER

Is just the tool for removing old flues from boilers and locomotives. Will cut 50 an hour. *Sent on approval* to Railroad Companies.

CAN BE OPERATED BY HAND OR BY FLEXIBLE SHAFT.

No Revolving Cutters. Plain Knives easily Ground. Leaves Flue Ready to Weld without Scarfing.

Manufactured and Sold by

VANCE TUBE CUTTER CO.,

GENEVA, N. Y.

SIGNAL OIL WORKS,

LIMITED,

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Manufacturers of

SIBLEY'S PERFECTION VALVE OIL,

The only perfect Locomotive Valve Lubricant.

J. C. SIBLEY, Prest.

Galena Lubricating Oil.

The STANDARD Lubricating Oil of America is the GALENA ENGINE, COACH and CAR OIL. Cold test 10° to 15° BELOW ZERO. It will not freeze in the coldest weather, and insures entire freedom from HOT JOURNALS at any time and under all circumstances, as its exclusive use on a majority of the leading railroads has demonstrated. It shows better results than have been shown by any other oil in the market.

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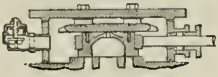
THE RICHARDSON AND THE ALLEN-RICHARDSON

BALANCED SLIDE VALVES.

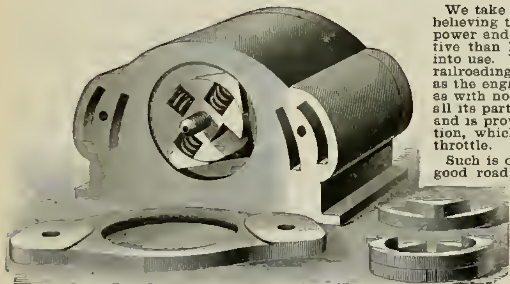


Used by 140 Railroads. 4,000 Locomotives Equipped. Great saving in wear of Valves, Valve-Seats and entire Valve Motion.

Manufactured Complete for any Locomotive.

Estate of **F. W. RICHARDSON**, Troy, N. Y.

THE TRIPP PATENT PISTON VALVE.



We take pleasure in presenting this Valve to Railroad men and others, believing that its use on a Locomotive Engine will effect a greater saving of power and expense in the maintenance of the working parts of the Locomotive than has been accomplished since the Locomotive was first brought into use. We also believe that its use will add largely to the safety of railroading, and prevent the destruction of many lives and much property, as the engine can be reversed as easily with 160 lbs pressure on the Valve as with no pressure, it being a **Perfect Balance Valve**. The Valve in all its parts is as durable as any of the working parts of the Locomotive, and is provided with a relief device, simple in its construction and operation, which relieves back pressure instantly when running with closed throttle.

Such is our confidence in this Valve that we will furnish a pair to any good road for trial, on their furnishing following dimensions: 1st. Diagram of cylinder face showing ports. 2d. Travel, inside end outside lap of valve. 3d. Distance from cylinder face to center of valve stem. 4th. Size of valve stem. 5th. Length, width and height of steam chest from cylinder face. Internal measurements.

Said Valves not to be paid for until they have demonstrated their value to the satisfaction of the road.

Prices, terms and additional information furnished on application to

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THE CAMERON STEAM PUMP.

COMPLETE WITH BOILER.

Send for Illustrated Catalogue.

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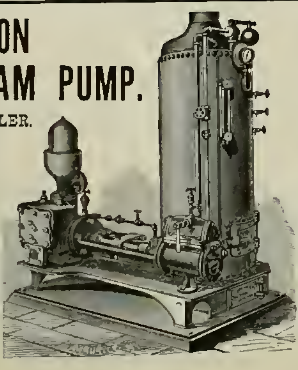

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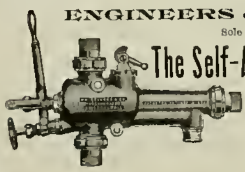
The Self-Acting Injector of 1887.



Range of Capacity over 60 per cent, and can be regulated, therefore, to work continuously for light or heavy trains. Never fails to promptly lift hot or cold water.

No service on a locomotive sufficiently severe to permanently stop its working

IT WILL RE-START ITSELF

should the Jet break from interruption of the steam or water supply, as soon as the supply is resumed.

ADJUSTS ITSELF

to varying steam pressures without waste of water. Increases quantity of water with increase of steam, and vice versa.

Very easily operated—Started by pulling out the lever, and stopped by pushing the lever in. Descriptive Circular & Price List sent on application to Office & Works,

PHILADELPHIA, PA.

The Locomotive Engineer.

Devoted to the special interests of locomotive engineers and firemen and to locomotive maintenance and repairs.

VOL. II, NO. VI. NEW YORK, JUNE, 1889. $1.00 per Year. or 10c. a copy.

Difference Between the Mouth and a Shovel for Firing.

When any master mechanic finds a man who is always lecturing on how ignorantly his locomotives are fired and handled, he should send him out on several different locomotives to fire—not to tell some one how to fire. If he can show a saving in fuel, a steadier pressure of steam without allowing the pops to sing excessively, if he prevents black smoke, or does a small per cent. of what he says can be done, then he is a valuable man, whom it would pay to commission as instructor. But if he discovered, as the most of them would, that cars actually have to be pulled over the road by the use of steam, generated by heat, caused by the combustion of coal, and that theory or scientific firing would not pull them alone; and if he found, as we fear he should, that locomotives are not like stationary engines in any way, that where a 100 horse boiler must be forced to supply steam for 500 horse-power engines, worked up to the very limits of its capacity one minute, then the engine shut off, the average economist would find it very hard indeed to prevent popping and the rolling of black smoke.

The firemen of the country are sadly in need of proper instructions as to economical methods in maintaining their fires; so are the engineers, for that matter, but it will be best for railway officials to select such men as instructors who can get upon a locomotive and do the actual firing with a scoop. There is a heap of difference between the mouth and a scoop for firing a locomotive in actual service, and keeping her smokeless, popless, and altogether lovely.

One is a pen picture of Adam enjoying the garden of Eden before the fall—the other a tableaux of him humping his back for a living after the light went out.

We have tried both plans, and know whereof we speak.

The sample room of The Locomotive Engineer office has been livened up by a nickel-plated rod cup, of the Northern Pacific persuasion, presented by Pedrick & Ayer, Philadelphia. We are glad it has a feeder in it—some railroader would be tempted to steal it for a snuff-box.

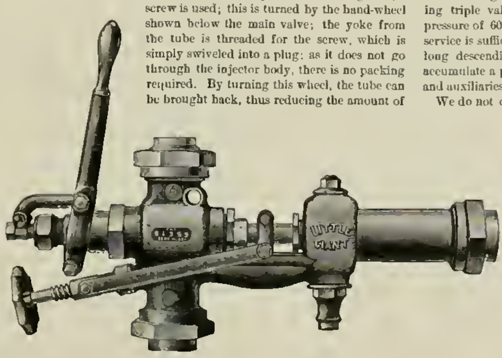
The Boyden brake—a recent improvement of the class where a fluid pressure is used to keep the brake off, and the reduction of which allows powerful springs to apply the brake—is being tested at the Westinghouse air-brake shops in Pittsburgh.

Little Giant Injector of '89.

The Rue Mfg. Co., of Philadelphia, have brought out a new form of their well-known "Little Giant" locomotive injector. While no changes have been made in the interior, the manipulating levers have been so placed as to enable the runner to adjust them quickly, without being obliged to fasten any part in place by set screws, and all of them arranged on the back end of the instrument, so that it can be placed through the cab without using rods to connect to outside levers.

The starting valve, which also operates the primer, is the same as in the older style, except that the lever is placed over and ahead of the valve stem, instead of behind it, this saves considerable room.

Instead of a lever to adjust the combining tube, a screw is used; this is turned by the hand-wheel shown below the main valve; the yoke from the tube is threaded for the screw, which is simply swiveled into a plug: as it does not go through the injector body, there is no packing required. By turning this wheel, the tube can be brought back, thus reducing the amount of water delivered, or entirely back for use as a heater, and is not liable to derangement, as the screw will stay in any position, and, of course, a finer adjustment can be secured while running.



Little Giant Injector of 1889.

The line check has been placed in the body of the instrument, thus reducing the number of parts and the length. This makes the instrument conform to standard practice, and it is interchangeable with all other standard injectors, without re-arrangement of pipes.

The center of gravity has gone up to almost twice the height originally considered safe in locomotive building, and a 60-inch boiler, with its center six feet above the rail, is now very common. The large passenger engine built by the Schenectady Locomotive Works for the C., M. & St. P., and described in these columns last month, has the center of its boiler 8 foot 9 inches above the rail. How is that for high?

The boys on the Erie have dubbed the Strong engine the "Missing Link."

Air-Brake Practice.

By J. E. Phelan.

THIRTEENTH PAPER.

One important point to be considered in connection with air-brake practice is amount and degree of pressure carried in train pipes and auxiliaries, and in main reservoir. In this particular, note eighth and ninth papers in January and February issues of The Locomotive Engineer for 1889.

When air-brakes are properly handled, an average pressure of 70 pounds in train pipes and auxiliaries will insure reliable and economical results for general service.

For average freight service, and with quick-acting triple valves and old style mixed, an average pressure of 60 pounds in train pipes for ordinary service is sufficient. When approaching steep and long descending grades, it may be necessary to accumulate a pressure of 80 pounds in train pipe and auxiliaries.

We do not doubt that the average rustler will get 80 pounds, and as much more as the pump governor will permit, or the pump supply. But 80 pounds air pressure, when applied in full force for braking power, will prove on an average very damaging to wheels, even with carefully adjusted leverage. More than 80 pounds pressure may prove destructive to wheels when applied with full force.

Where 80 pounds air pressure is maintained and used with judgment in service stops, or used expansively through medium of the small valve within the slide valve of the triple valve—note fourth paper in August, 1888, The Locomotive Engineer—when used in such manner, 80 pounds pressure will do no harm, but usually can be relied on for fair and effective work.

But where the engineer's brake valve is handled like a meat axe, such pressure is not economical in practice. Such pressure is not safe to keep in store for a sudden application; often to save a ten dollar cow will damage a hundred dollars worth of wheels.

It is our belief that amount of pressure transmitted to train pipe and auxiliaries should have a maximum limit of 70 pounds for mountain grades as well as ordinary roadway.

For mountain grades we would advocate maintaining this limited pressure, but increasing the volume by having double storage capacity for air in main reservoirs, *i. e.*, where necessary, simply add another main reservoir, and carry two instead of one, making them tributary to each other and train appliances.

In our way of thinking, this increased volume of stored-up air would lessen the necessity of accumulating high pressure in order to maintain an average and effective pressure in descending long grades.

Provision for maintaining medium pressure, and enough of it, means economy in all directions.

We once fired an engine designed to handle three passenger coaches. This engine was equipped with a main reservoir, with capacity about equal to the needs of three air cylinders; but, as I viewed it, not equal to combined capacities of three auxiliary reservoirs if the auxiliaries should be emptied in making ordinary stops.

With this main reservoir, after a stop when auxiliaries were re-charged, pressure would run low, and the pump, in consequence, quite fast.

It seemed a perennial jumping from garret to cellar—up and down.

Occasionally we went out with an extra engine, while our regular engine was in for repairs. The extra engine was equipped with a standard main reservoir. The results were apparent in a moderately running pump, more uniform pressure, and more effective and desirable service.

With the smaller reservoir, pressure was quickly gained, but suddenly lost. With the larger reservoir it would take longer to get pressure required, but once gained it proved lasting, and not apt to desert us when urgently needed.

The natural suggestion to my mind is to apply this principle to the indefinite coupling into one long string of air-brake cars.

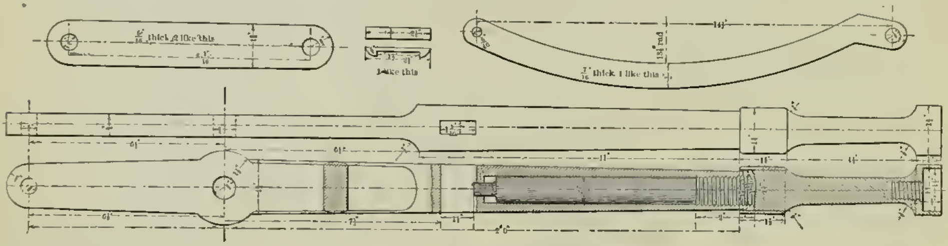
If we aim persistently in providing for and insuring proper results, the future will show most efficient air-brake practice. To gain this important end,

The usual programme is to start out with full equipment of brakes until first stop is reached, sticking commences, and the brakemen begin bleeding and cutting out one or several brakes at a time, until number remaining in use corresponds with capacity and ability of engineer in charge to handle them; this point reached, everything goes along in proportion to energy on hand. The engineer don't have to exert his mind beyond its limit, and the brakemen enjoy the industrial repose in sweet content, while the conductor simply dreams of one needed advance to make life free from care, *i. e.*, transfer from caboose to Pullman.

But to get back in the line of horse sense, there can be no avoiding the fact that, in order to have effective working brakes, and to insure the service in emergency for which automatic brakes are designed, a degree of skill is required, and constant perseverance on part of all employes in charge or connected with air-brake service necessary.

We often hear of engineer's brake valves failing to keep reserve pressure in main reservoir; engineers often declare it impossible to keep brakes from setting when engineer's brake valve is set for feed position.

Where such opinion exists, let engineer in charge set valve in feed position with full air pressure, and pump working; then get down and hold uncoupled air-hose at rear of tank, and open stop-cock. Trying the feed in this way when stop-cock opens, the accumulated pressure escapes suddenly, then the gradual and uniform feed continues through feed valve. One can feel amount of air passing out, that, when coupled, passes back to



Richmond & Danville Throttle Lever and Latch.

careful and persistent effort must be required of all in charge of appliances.

The easiest way to tell a successful and competent air-brakeman is to note results accomplished.

Some men are always crying about brakes sticking, and while cussing the appliances and lack of repairs, and rawhiding the train brakemen for not bleeding sticking brakes, they fail to hear the emphatic remarks of the train brakemen concerning practice, or lack of practice, in hand.

Somehow, brakemen have absorbed the idea that air-brakes ought to be released from the engine, and by the engineer in charge.

They seem to gain this idea from the fact that some engineers pull them frequently, and never require bleeding of brakes. Other engineers, with the best of brakes, require a regular and systematic bleeding of brakes at all points, and an occasional forced stop requiring brakemen to get down, bleed a brake, and cut it out.

With the application of air-brakes to freight trains, brakemen come into a heritage of what may be called industrial repose.

Of course, many engineers consider it cruel to disturb a brakeman's rest for the purpose of bleeding brakes, or any other form of exertion, and when certain engineers carry this cruelty to extremes, brakemen on air-brake trains naturally infer that, if some engineers can release brakes, all engineers ought to.

We would suggest practicing such cruelty in requiring brakemen to locate and remedy leaks about appliances on cars, thus before starting aiming to avoid sticking of brakes.

Meeting a freight train equipped with air-brakes in ordinary repair, one can, by casual inspection and counting number of air-brakes cut out, judge the capacity of men in charge.

train appliances for needs of brakes; and this amount can be relied on to be sufficient for usual requirements, unless leading pipes waste more air than the volume passing through feed valve can supply.

This opening and trial practiced occasionally insures cleaning of feed valve and pipes; for the air rushing out, to begin with, finds free and easy passage, and continuing to flow freely, carries with it any light deposit or dirt in passages.

When coupled up, and flowing against counter pressure in train pipes, this clearing will not occur

We have noted this practice often remedies complaint concerning defective feed valve.

Richmond & Danville Throttle Latch.

The best and simplest throttle latch that we have ever seen is in use on the Richmond & Danville road, and we are indebted to T. W. Gentry, master mechanic at the Manchester shops, for the blue print from which the accompanying engraving was made.

As will be seen, the quadrant is simply a piece of steel of square section, curved to the proper radius, and fastened to the boiler head or brackets, where used on side of boiler; this quadrant works through a slot in the lever, which is fastened rigidly to it by an internal screw, as shown.

The cut shows only the iron-work; upon the end is fastened a wooden handle, fitted to the ferrule shown, and held in place by a stud passing through a cone-shaped nut on the outer end. This makes a good handle to grip, and is always cool. The runner loosens the latch by twisting the lever toward him slightly; this slacks off the large screw in the lever; the throttle is adjusted just where it is wanted, and fastened there securely by a simple twist of the wrist. There are no projecting screws, rods, pins, latches, notched wheels or sectors; the throttle is as plain and simple on the outside as a common one without its set screw. It is therefore easy to clean, and not liable to derangement.

As the screw bears against a steel gib, it does not mar the bar. These throttle levers have been in use on this road for a number of years, but the motive power officers do not claim to have originated it. It is so superior to the common breed, so simple, so cheap and so safe, that we would like to see more of them in use. The engraving is plain, and the sizes being given thereon, any mechanic who can get to a lathe can make one from it.

Air-Brake Valve Models.

Through the kindness of the Westinghouse Air-brake Co., this office has been provided with one of their new, quick-acting, triple valves, and an engineer's brake and equalizing discharge valve. These are full-sized valves, with portions of the case cut away to show the action of the mechanism.

By the use of these sections a student of the subject can see just what takes place under certain conditions, and can learn more about the valve in one good look and explanation, than they can in forty explanations without the models.

The models are on exhibition at this office at all times, and the writer will take pleasure in showing them, and explaining their action to the best of his ability, to engineers, firemen, or any others interested in air-brake subjects.

Railroad Geography.

Railroad men should see that their children are provided with good geographies.

Teaching them from railroad maps and folders would be liable to distort their knowledge of such matters, and make them think Baffin's Bay bounded Missouri on the east, and the Mississippi emptied into the Mammoth Cave, or Salt Lake.

We were recently shown a well-executed map of the United States that showed the country almost in the shape of a fan, the Atlantic States being the handle, and the Pacific the top.

These maps showed one of our Southern roads, with Eastern connections at Baltimore and Washington, to be almost a direct line West, and reaching, centrally, into the great Western States.

These maps were made for foreign distribution, to induce immigrants to buy tickets direct over this line.

We are informed by map engravers that there are very few railroad maps made that do not have the geographical location of cities, rivers or boundaries distorted to show that the particular line of road issuing them is the "great and only air line running through, vestibuled cars, without change, from Halifax to Honolulu."

W. E. Lockwood, him of the hammer blow, has got out his pet engine, the Shaw 4-cylinder machine, and is going to give the Strong a whirl on the Bound Brook. The Strong weighs just about twice as much as the Shaw, but it is thought she will handle four cars about as well as her big rival.

The Cooke Locomotive and Machine Works, Paterson, N. J., are moving into their new shops.

Air-Brake Notes.

The new shops of the Westinghouse Air-Brake Co., some 12 miles out of Pittsburgh, are not yet near completion, and will not be ready for occupancy for several months.

Work is slack, the shops being run but four days per week. Many experiments, and some changes in detail of the new quick-acting brakes have been made of late, until now it would seem that there is nothing further to be desired.

They have recently adopted a cock for bleeding the auxiliary drums that is operated by pulling a wire at either side of the car, making it unnecessary to go under for that purpose.

The engineer's brake and equalizing discharge valve has been simplified, the loose valve or dashport on the piston has been done away with, and the accumulation of gum and dirt prevented.

During a recent visit to Pittsburgh, we had the pleasure of a visit to the company's instruction car, which was just back from a 3,000 mile trip through the south, and which has since been sent to the Santa Fe system.

This car was designed by E. W. Newell, chief draftsman for the company; it is sixty-eight feet long, and is divided into two compartments, the office containing two Pullman bunks, a desk, cupboards, wardrobe, sofas, etc., and the instruction room, containing the apparatus.

In one corner of the end of this room is located a twelve-horse Westinghouse boiler, in the other a Westinghouse engine and a dynamo; this dynamo furnishes the current for some sixty incandescent lamps; on the wall, beside the boiler are two pumps for furnishing air; through the center of the car there is a frame containing 30 complete sets of automatic brakes, set in an upright position to save room; on the sides of the cars are tender and driver brakes, and also a fifteen car equipment of automatic whistling signals. On the walls and in other convenient places are located sections of the valves and other working parts of the brakes, enabling the instructor to show how and why the different devices operate as they do.

Engineers and firemen can handle the actual brake in the car, and also see by a section just what has taken place in the mechanism.

The car is heated by steam, has a water tank of 700 gallons capacity, fire apparatus, and is so equipped that, when in a train, the brakes can be operated from the car, or air furnished if the engine pump fails.

There is a six-wheeled-truck under the end where heavy machinery is located, and a four-wheeled truck under the office end. Ross-Meehan shoes and Westinghouse steel brake beams being used.

The interior of the car is finished in quartered oak, and is as handsome as a Pullman, the beauty and convenience of the whole thing reflecting great credit upon the designer.

The car is under the charge of W. H. Hartman, an eminent and progressive young engineer, who formerly ran on the Vandalia, but has been for the past five years an instructor in practical mechanics at the Rose Polytechnic Institute at Terre Haute, Ind.

The car is sent without expense to any road using the brake, an intelligent runner who knows the men appointed to assist, and lectures given on the subject. Mr. Hartman is thoroughly up in brake science, but is a practical engineer, and gladly answers any questions asked. If this car comes within your reach, don't miss it. It will be worth money to you.

The Pittsburgh Locomotive Works are preparing the ground and putting down concrete foundations for their new shops.

Weaver's Grate.

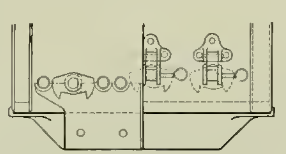
The accompanying engraving shows a plan of rocking grate adopted by Master Mechanic J. N. Weaver, of the Lehigh Valley road, for some large 12-wheeled locomotives.

The grates lay between water bars, and are independent of each other, and differ from other shaking grates in that they have no coupling bars or shaking rigging.

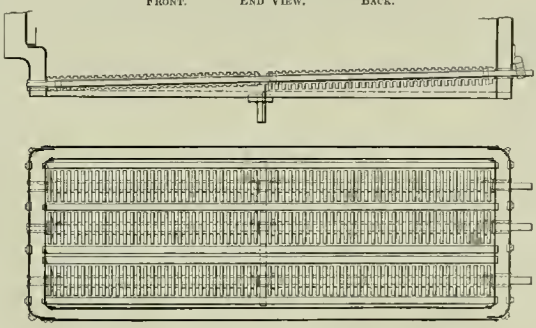
The shaft of each bar projects through a thimble in the back head, and is rocked by applying a socket wrench to its squared end.

It would seem as if it were impossible to cock such a grate, as each section is independent of the other, while the doing away of all operating rigging under the deck and in the ash-pan is an advantage that will be appreciated on the road. The grate must be easier to shake, as a man does not have to lift the entire load of fuel on the grate.

The grates are inclined as shown in the end view, and are held from turning by hinged forks that drop over the square ends.



FRONT. END VIEW. BACK.



WEAVER'S GRATE BARS.

Jack the Ripper.

The Webb compound locomotive, Pennsylvania, *nee* "Jack the Ripper," is pulling the Paoli accommodation out of Philadelphia. This is one of the hardest runs in the country for a compound; they pull five and six cars, run 20 miles, and make 19 stops in 50 minutes.

If the compound can make this run on time, she is a daisy on the start—we do not think she has or can do it. She will soon be tried on the New York division, where she would have some show of proving what there is in her.

The new Canadian Pacific connection across the northern wilds of Maine to Halifax is completed and opened. The first train was all day going nine miles. Gray caterpillars by the thousands got on the rails and greased the right of way enough to skid all wheels. Western railroaders will smile at this, and remember the circuses we used to have with grasshoppers.

Our correspondent, F. C. Robinson, late general foreman of the Wabash shops at Danville, Ill., has been appointed General M. M. of the Atlantic and Danville Railway, with headquarters at Belfield, Va. Progressive men get the responsible places—and keep them.

Bee Line Shops.

During a recent visit to Indianapolis, we visited the Bee Line shops at Brightwood. These shops, when built, were no doubt considered fine railroad shops, but they have depended upon their reputation for superiority in later years. The shops are good ones, roomy, and not crowded too close together, but the most of the machinery is comparatively old.

They were cutting up four old scraps that have done service ever since the line was started, old-fashioned 8-wheelers with incline cylinders fastened to smoke-box.

The new engines for passenger service are mostly Brooks' build, although some very fine-looking Schenectady engines were in the house. Most of the freight engines were built at the Cleveland shops, or rebuilt there, losing their original identity in the process.

This road has used for years a peculiar form of sand-box, set up on a small central support, and having the pipes fastened to the bottom by a union; the new engines have common, every-day sand-boxes, however.

The shops are clean, as are also the yards about them.

In the back shop a number of locomotives were being rebuilt, some getting new boilers; they had just got a half re-built mill back on her blocks after having slipped on the jacks and turning over, fortunately catching none of the dozen or so of men at work on her.

They employ here a very neat draft iron for the rear of tenders, that has a heavy lug on its upper side, and a wrought-iron buffer plate hinged to it. A fixed buffer plate on a passenger engine often makes it impossible to couple to a freight train, and an engine ahead of a passenger train with a foot or two of slack and no driver brakes, can knock all the care and skill out of the best handled air brake on earth.

The company owns and operates a hotel, the "Brightwood Home," near the shops; it is intended for the men entirely, and has convenient sitting rooms, provided with reading matter, etc. It is a big improvement over the common hash foundry with bar attachment, but it would be lots more enjoyable if it was scrubbed out occasionally.

An English Opinion of the Webb Compound.

Clement E. Stretton, C. E., an eminent mechanical engineer, of Leicester, England, writing to the Engineers' and Firemen's *Journal*, of Leeds, says:

". . . It is a fact worthy of note that in this country the working of the compound system has never been fully and fairly compared with the working on ordinary engines; the compound has always had the advantage of 25 or 35 pounds more steam pressure.

"Compound locomotives have 175 pounds of steam in their boilers; they are provided with the best coal, best oil, and kept in first-rate order; the ordinary engines have only 140 lbs. steam pressure, and have to burn any coal. . . . .

"American engineers will test the compound sent over there with one of their locomotives capable of carrying 175 lbs. pressure, in order that the comparison may be perfectly fair

"Already the advocates of the compound system are beginning to consider that the Americans ought to come to the trial with one of their ordinary engines with only 140 lbs. pressure.

"It will be very interesting to watch the results obtained in America by the Webb engine, but it is to be regretted that, if the Pennsylvania Company desired to purchase an English locomotive, it did not obtain one of the best standard patterns of English practice."

The South Australian Government has agreed to pay £10 ($48.70) to every engine driver who runs his train two years without an accident.

A New Belgian Locomotive.

On this and page 5 will be found a plan and elevation of a new design of passenger engine, recently adopted by the Belgian State Railway Administration, for practically level roads. This engine was designed and built by the Société Cockerill at Sening, and is exhibited by them at the Paris Exposition.

The engine was designed for burning slack of a poor quality, and it is claimed that engines of this class make 68 miles per hour in regular service; and the designers claim that by the peculiar style of equalizing they get extra good results, in easy riding, at this high speed.

At a speed of 59 miles per hour this engine pulls a train weighing 180 tons, including a tender, 6-wheeled, carrying 3,080 gallons of water up a grade of 1 in 200.

The dome is flanged near the bottom, instead of the top, so that when the cover is taken off the throttle and pipe are entirely exposed.

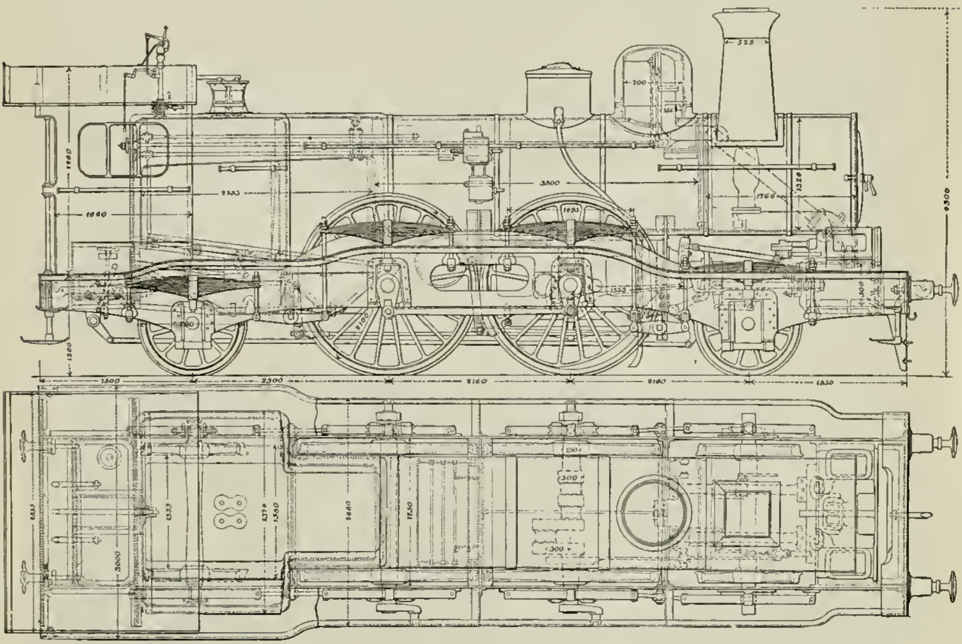
The outside plate frame and side rod cranks are peculiar to European practice.

A modification of the Walschaert valve gear is used, and the inclined steam chests, set about half their length ahead of the extension, are a novelty to Americans.

The principal dimensions are as follows:

Heating surface, fire-box	130	sq. feet
" " tubes	1,237	" "
" " total	1,367	" "
Grate area	53⅝	" "
Cylinders	20x24	
Diameter of drivers	83	inches
" " truck wheels	48	"

We are indebted to *The Engineer*, London, for our cuts and data.



A NEW BELGIAN LOCOMOTIVE.

There is a spring over every box on the engine, those over the drivers being 5 feet long; the springs are equalized together, something seldom done in that country; the equalizers between the leading wheel and forward driver are pivoted to a cross-equalizer, which is pivoted in the center to a rigid brace from the boiler or frames. The springs are simply straight pieces of steel cut to the required lengths, no drawing down of ends being required for this form.

The fire-box is on the plan of the American, hay-wagon, slack burner, but is narrowed up in front to allow the large driving wheels a chance to work beside, instead of under it. The boiler has the Belpaire, square top, fire-box, which is nearly 10 feet long ($2\frac{1}{2}$ meters); the cylindrical part of boiler is 12 feet 6 inches long, containing 242 iron tubes, 1¾ inches internal diameter.

An extension front is used, and a very large, square stack. As will be seen, the steam pipes extend to front of extension to join the cylinders, which are located ahead of the leading wheel. The total length of engine over all is 35 feet 6 inches; wheel base, 25 feet 6 inches.

The total weight in running order is 49 tons.

The engine is equipped with the Westinghouse air-brake, and driving brakes are used.

A Lively Little Shop.

It has been our experience in traveling about the country that big railroad shops are about all alike, and not very modern or interesting, except when new, but that small shops, required to keep up considerable power with few tools, poor facilities and no money, usually develop men, and the men develop methods both original and interesting.

At the O. I. & W. shops, in Indianapolis, we found a little shop hustling around and doing more work on fifty square feet of territory than half the big shops do on an acre.

The shops are small, but all departments are worked up to their capacity.

The locomotives used in passenger service are 8-wheelers, mostly Rhode Islands, and are kept up very nicely. Many consolidation engines are employed on freight. Extension fronts are employed and run from one year to another without sparking, and this, too, without throwing cinders or burning the paint off the front end.

These shops are under the charge of Master Mechanic John King, a practical engineman, and his trade-marks are everywhere.

The road is a combination of several small lines, and, of course, there were originally many different kinds of locomotives to contend with, but these have been brought up to the times, and as near standard as it is desirable to have engines. Mr. King makes solid rods of his side rods by taking out the key and putting on a new strap. All rod bolts have square heads, making them easier to handle without the monkey-wrench gouging the corners off. Fluted, or I section side rods, are made as cheap, or cheaper than ordinary rods, by leaving the rod the same side throughout, and not finishing up a stub-end at all. This saves lots of machine work, but makes a pretty heavy rod, or one with extra large and heavy straps and brasses, but it is intended in the next ones built to make a wide rod, but to let the strap into it flush instead of putting it on outside.

Some Healy, 8-wheeled, 17 x 24 engines, 7 feet between centers of driving wheels, have recently received new boilers, much larger in diameter than the old ones, and two feet longer, the drivers being spread to nine feet. These engines are very hard to beat, being free steamers and very smart.

Mr. King is putting an angle piece of $\frac{1}{16}$ steel, in the shape of a try-square, under the corners of the packing strips of Richardson balanced valves, to prevent the springs from cocking one piece up, and binding its corners against the others. Many of the engines are equipped with the Bristol roller valve, a plain slide valve supported on steel rollers placed in a frame, and resting upon the valve seat at end of ports. They work very satisfactory there—one engine having made 4,000 miles per month, on passenger, for two years without repairs, and in good condition yet.

They run cheaper on oil here than at any place we have yet visited, and use for everything, except valves and cylinders, crude oil, costing but six cents per gallon. On engines coming in from long runs you see no oil slobbered all around the pin collars. The cup used on rods is illustrated in this issue.

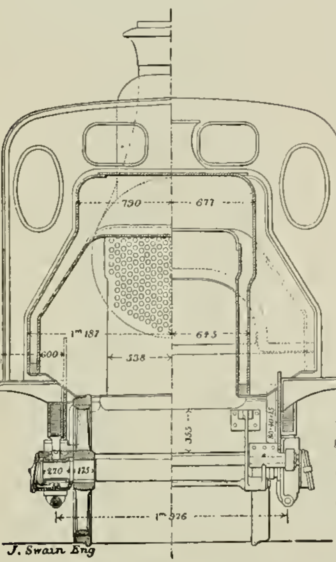
Like almost every road in the country using heavy locomotives with small wheels, they have had trouble with the counterbalances—engines riding very hard at fast speeds. All the consolidations have had extra counterbalance weights riveted into the wheels at each end of the weights cast in, and the men claim a big improvement in the riding qualities.

There are being built in the shop a couple of 6-wheeled switchers of heavy design, that, so far, show extra good work. The boilers are splendid specimens of work, all longitudinal seams, double riveted with welt, inside and out. All the stay bolts in side sheets and back head are the same length, and the top sheet is flanged and double riveted to the dome; in some new boilers to be made there will be two rows of rivets in the mud-ring. The frames are forged solid and finished all over, and a generous fillet left in every corner.

Four-inch tires are to be seen everywhere, Mr King being a believer in their superiority over thin tires, in safety if in nothing else.

In the passenger engines lengthened out, the frames beside the fire-box were stiffened by putting an I piece in the center between the frames, and running a brace in the shape of an arch-bar from the lower rail of the frame and the pedestals over this I piece, with both ends fitted against the jaws, and secured by fit and taper bolts, it makes as strong a job as a heavier frame.

They make a splendid steel frog here for the small sum of $13 each, using a malleable iron filling of their own pattern; this filling fits the sides of the flange and head of rail, and the bolt holes are cast into it large enough, so that the bolts do not touch the filling piece, hence do not shear or wear off.



All injectors have overflow pipes screwed into them solid; there is no slobbering of water, steaming of windows, rusting of jacket, and scalding of paint from the steam and hot water that always offers up burnt offerings from every open overflow in the country.

The firemen have a trick of painting the barrel of stack, and sometimes part of front door, with plumbago, that gives the iron the appearance of silver at a distance, and polished iron nearer. It looks very neat with the jet black of front end.

The Strong is wrestling with a four-car express train on the Reading, between Philadelphia and New York. If she really could pull 30 cars at 80 miles per hour, and the engineer "holding her back," it ought to be no trick at all for her to make an even hundred miles per hour—especially if the engineer could be induced to let her out.

Barnum's circus, 40 cars, was the first paying train to cross the great Poughkeepsie bridge.

At the Pittsburgh Locomotive Works.

The Pittsburgh Locomotive Works are preparing for the foundation of their new shops; these will cover much of the ground now used as a yard, and the new machine shop will be built over the present machine shop site. This will call for the removal of the hundreds of heavy machine tools, with their maze of shafting and belting, the erection of the new building where the old one stands, and the setting up of the machinery; and all this while doing their regular work.

Locomotive building is comparatively dull now, and Supt. Wightman is improving the time by rebuilding machine tools that are in need of it. The machines are brought into the tool room and thoroughly overhauled, strengthened where weak by new or heavier parts, gears changed to make the speeds or power what is required for the work, etc.

These works do a great deal of forging to required shapes for locomotive work, and the hammer shop is full of dies for this purpose.

At the time of our visit, there were in the erecting shop a number of 10-wheeled engines of heavy pattern, two 8-wheelers, and several little 7x12, iron cab, small wheel crabs for work about steel works. They were also rebuilding some old engines.

We noticed on cylinders for 20-inch bore and high pressures, that a cylinder head with heavy spoked braces is used.

They drill a hole back of the key-way through the sleeve of the valve rod where it couples to the stem, so that a punch can be introduced to force the stem out in disconnecting.

Many manufactories in Pittsburgh have gone back to the use of coal as fuel, on account of the increased cost of natural gas; this comes from two reasons: first, the control of the gas by monopolies, and second, by the reckless waste of gas by the workmen.

Coal has to be shoveled into a furnace, and the men are glad to take every advantage that will prevent exertion in shoveling, but gas goes in itself, and they simply "let it hum."

Fearing that a considerable reduction in pressure would be annoying in the works if piped as usual, Mr. Wightman piped these shops with 4-inch gas pipes, so that in event of low pressure, he would have a large volume to draw from, but soon found that every furnace was run with all the gas they could get, arguments were useless, the men declaring they could not get a heat in any other way; gaskets with a hole only an inch to an inch and a half were placed between the flanges of the pipe at each furnace, and has apparently met with no other result than the reduction of the amount of gas consumed.

J. H. Setchel, President of the Master Mechanics' Association, and lately superintendent of the Brooks Locomotive Works, is now connected with the Pittsburgh works as agent.

Vandalia Shops.

The shops of the Vandalia line, located at Terre Haute, are old ones, and not out of the general run of shops built in a hurry 25 or 30 years ago in the then West.

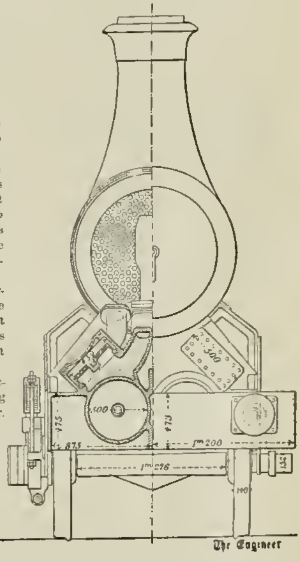
The roundhouse is a complete circle, containing 30 stalls, and has an open center; most of the roundhouses through that section of the country are cursed with a pall of darkness in the shape of a covered center. The road is remarkably free of old locomotives in road service, as compared with other roads of its age. Most of the new locomotives are Pittsburgh build, and heavy 10-wheelers are used on freight, old scraps for switching purposes. The road uses the Janey coupler on passenger cars, Westinghouse brakes and signals. The erecting shop is separate from the machine and other shops, and has in it a turntable, a transfer table, and a power hoist for picking up a locomotive bodily to remove her wheels—a rather cumbersome and expensive process as compared with modern transfer jacks.

The machine shop is small, fairly well equipped with tools, but most of them would be grey-headed if they had hair.

The power is derived from an old-time, long stroke, independent cut-off engine that has been in its present position and in charge of the same man since 1852.

They have some modern tools in the boiler shop, and had, at the time of our visit, a couple of new boilers completed for new switch engines; these shops have built some fifteen new engines in the past two years.

The company build their own cars and coaches, and a new paint shop recently erected is especially well arranged; tracks are laid over very shallow pits of cement, the cement extending outside the rail far enough to let all drip from sides of car fall upon it, instead of the floor. The cars stand close together, and there are two rows of posts between each track; on these posts are arranged simple folding brackets that allow the painters to fix their painting stages at any height, and the full length of the car.



On some of the locomotives Cooke bell ringers are used, and on others the White bell ringer—a device worked by air.

Some of the engines are still provided with Supt. of M. P., Prescott's sparking arrangement for extension fronts; this is a cast-iron soap kettle fastened under the arch and containing water; it does not work well enough to pay for its maintenance, as they are being side-tracked as fast as the engines go in. They run the deflector out ahead of the nozzles now, put in netting with a large mesh, and the sparks go out of the stack—where they belong.

We are in receipt of a communication from an old marine engineer at Racine, Wis., who objects to the way some correspondent refer to "Drivers on the Water," about a year ago, and states some of the difficulties in the way of, and requirements of a marine engineer, that locomotive engineers could not cope with. A marine engineer would be about as useful on a locomotive as a locomotive engineer would on a steamer; they are both good men in their places, but when any engineer claims to know everything about all classes of engines, he can be set down as a little out of balance.

An Economical Oil Cup.

We present on this page a cut of a simple, cheap and effective oil cup, in use on all the locomotives on the O. I. & W. road.

They are plain brass cups, with a square cap for wrench; the feeder is independent of the cup, simply has a ball joint at the bottom, and consists of a brass shell, into which is driven a copper tube, long enough to reach through the cup almost to the pin. Through the sides of this brass post and its tube a number of holes are drilled, and a wick is drawn tightly through it, and a cork placed in the top. The brass post extends up into the cover, forming a guide that prevents crossing the threads in putting cover on. The feeder can be removed from cup by the fingers, and oil used directly on pin.

On this road they use three sizes of these cups, the larger being 2¼" in diameter and 4" high, the smallest 1½" in diameter and 2¼" high. Small size is used on side rods for consolidation locomotives, and with crude oil, costing but six cents per gallon, they run from three to six weeks with one filling. A cup was taken off an engine for our examination on the 13th of May, that had been filled on the 1st; it was about ⅞ full of oil, and had run over 1,000 miles.

The cups cost but a trifle over $1 each, and are much stronger and neater than the average cup in use.

Correspondence

Not Always the Notch that Counts.

Editor The Locomotive Engineer:

I am glad to see some of the boys are working the throttle and lever question. But it seems some of them have got too many notches. While I believe in working the steam expansively, I know there is such a thing as going too far. It has been my experience that if an engine will do her work at ½ stroke, and a good stiff throttle, she can't be changed to advantage. This question of notches is no comparison; most of our engines cut-off at 6" or 7" in first notch; one of the boys in Canada says his is 3". I once ran a passenger runner on another road, handled a train of five coaches, in the first notch *back* of center, and she worked good and strong.

———, *Ohio.* SKIPPER.

[The writer had a little experience like this, but found out afterward that the reach rod was two inches too long.]

A Few Facts.

Editor The Locomotive Engineer:

It is a fact well known to all railroad men that their respective companies get an economical streak about once a year, and nine times out of ten when retrenchment comes it strikes the locomotive department first, under the plea that the operating expenses are too high; cut down the mechanical force, use less coal and oil on the road, pinch and squeeze at the spigot, but let the leak at the bung continue. Are the operating expenses too high? We admit they are, under certain circumstances. The general office goes after the general M. M.; as he is not omnipresent he goes after the Div. M. M., in a circular letter, and he, again, jumps the foreman, and he bounces a lot of men. Expenses, in regard to wages, have been reduced a little, but the running expenses are still high. A notice is posted on the bulletin board, signed by the Div. M. M., that engines are using too much coal and oil per mile. Right here comes the injustice to engineers; we well know that it takes coal to pull heavy trains, "and if you drop her down and knock it to her," it takes more coal; it also takes oil to keep things cool; "time freight" and fruit must not be delayed; extra coal and oil used under such circumstances are legitimate. But show me an engine that is always howling at the station, and I will show you an engine that has a lot of dampers hanging loose, admitting air enough, when shut, to keep the engine popping all the time, and if the air-pump is kept running it is so much worse; that engine is burning lots of coal, and doing no work to show for it. Show me an engine that burns lots of coal on the road, but is not steaming and doing her work in proportion, and I will show you an engine with packing or valves blowing. Is it any wonder that such engines are expensive to operate? At the same time the engineers get notice that they must run with less coal and oil; how are they going to do it? They are not supposed to do their own running repairs, and they cannot get them done. Dampers and ash-pans should be as near air-tight as a front end; it is the foreman's place to see that they are so made, but he don't do it. Perhaps he wants to talk to some one, and don't have time to attend to his business, and very often don't know his business. There are plenty of good men in such positions, and some not worth the powder to blow them up. An engineer reports his valves or packing blowing, the cover or cylinder head is taken off, when this modern Solomon looks in, looks wise, says *they* are all right, and walks off. A request is made to have an engine's valves squared (and we all know that almost any engine that is square, with valves and packing tight, will do good work;) but it is not done, and the engineer goes out and tries to make time with an engine that won't make time, by being handicapped by the cussedness and ignorance of the foreman.

What reflects more on the ability of a Div. M. M. and his foreman than to hear an engine go limping and wheezing over the road?

KING'S OIL CUP.

Running a locomotive may not be classed as skilled labor, but it takes brains; and I venture the assertion there is not a class of men connected with railroads who are subject to so much worry and anxiety as locomotive engineers, providing, of course, that he cares a continental how things do go.

If some of the men who get into position as Div. M. M. or foreman (not on their own merits, but by virtue of the "power behind the throne"), knew what it is to have to nurse and coax a defective engine to get her over the road, and to have the train dispatcher hounding to know why do you not run faster or knew how to run a locomotive at all, they could appreciate an engineer's troubles on the road, and see that his engine was right when she went out; but they don't know, and care less.

The foreman of a division shop should be a practical machinist and engineer, and know each branch well enough to put up an engine, take her out on the road and run her successfully; and if he does not know these things he has no business in the position.

If a little "civil service" was used in putting men into positions on railroads, it would be better for all concerned. W. DE SANNO.

Tulare, Cal.

About the Swinerton Locomotive.

Editor The Locomotive Engineer:

If you will look on page 408 of the *Fireman's Magazine*, you will see that even so old a railroader as Mr. E. J. Rauch can have his eye shut very easily.

He has been riding on the Swinerton Flat-Driver locomotive, and endorses her as a great and good invention. Says she beats other engines of same dimensions, that the flat spots give her more surface in contact on the rail, and thus more adhesion, and that she has worn her driving tire down an eighth of an inch, still preserving the facets. I have not only been on the Swinerton, but about her for many days, and will simply say that Mr. R. has been misinformed about the weight on drivers. I understand that some of this weight has been taken off, as the driving-boxes run hot all the time, but the original weight was 41,000 pounds on drivers, and this could be increased by traction increaser to 47,555—considerable difference between that and 24,000.

Now, about those facets. I cannot find one, except some interested person shows it to me (?) and, if, as Mr. R. says, an ordinary wheel rests on the rail only in a mathematical line, the Swinerton would not touch at all when going from one facet to the other; and if the surface in contact determines the amount of adhesion, instead of the weight controlling it (as all laws of physics declare), why not make the rails ten or twelve inches wide, and the drivers the same?

Now when Mr. R. tells us that a driving wheel, with 105 little flat facets milled upon its tire, can run for a year, and wear down an eighth of an inch, *and still keep the flat spots intact*, why—I don't believe it. I would not believe it if I told it myself; it is not natural, it is not mechanically possible—it would wear off those corners, sure.

I send you herewith a photo of the "Onward," with all her weights noted.

Lexington, Mass. A FIREMAN.

Schemes and Schemers—John Alexander's Warning.

Editor The Locomotive Engineer:

If you have got through dodging all those fellows who have shied a brickbat at you for letting me say I didn't believe in *always* working a locomotive wide open and hooked back, why, just lop your ear over here—I want to pour something into it. I'm mad, Mr. Editor, mad as a bay bull at a county fair—who wouldn't get his dander up to go and be fined for drunkenness when it was one of his pesky neighbors who he never spoke to that was drunk, and not him at all?

Wouldn't you go on the war path yourself if the town authorities sent your children home from school and guarded the house because Tom Collins' kids had the small-pox or the 'leven-year itch?

'Sposen Flat-wheel Ellis burned the crown sheet out of his old pelter, and you was called up with all the rest of the gang and fired for it? Wouldn't you get hot? I know you too well to think you wouldn't, neighbor, too pesky well; I know what you'd do—you'd swear, that's what you'd do; 'en you'd rase up them lily white hands to high Heaving, and swear by the Continental Congress and the bow-legged General Jackson that you'd have blood! blud! B-L-U-D D!!!

I'm a peaceable man, Mr. Editor; I love peace, but I am riled up now and I've got my red shirt on—when you see me with my red shirt on I've been taking iron—when I've been taking iron I'll fight.

We had a decent road here once and several men had been taught their p's and q's—you know what that is—we all pulled along together sociable and family-like, but one day our master mechanic hired an old chronic to run amongst us; he was one of them critters that always knows more stuff that ain't so than everybody else knows that is so.

We were running "first in, first out" on our division, and had one local run that was simply a job of switching in a yard 113 miles long and one other hard run that went out at 10 P. M., that was hard and nobody wanted, and everybody felt sorry for the fellow that had to take it out; but as there was a couple of dozen of us no one man got it very often

Now the fast freight always caught that local, but the local let it pass and the fast freight man always left a line on register for the local man to register ahead of him and thus take his turn back and get his lay-over at home.

Now Chronic was on local the first few days, and it was all right; then he got a fast line a few whirls, and it killed him to see that other man go home ahead, so he went and sung a little song to the M. M., who was busy and disgusted, and he put up a notice that the men should run by the rules—"first in, first out."

Then came a squabble among the men; the man on local blocking and holding back the fast freight, and the fast man trying to get ahead and run around his less fortunate brother. Then Mr. Chronic got a good fit on, and after running around a man he told the night foreman it was no fair deal, and he registered the other fellow ahead of him and the other man said that old Chronic was a good fellow after all, and stuck to it till the caller went for him to go out on that night run, and he discovered that Chronic had been back over the register and "figured" a little—that other fellow was me.

Then we all commenced to figure; we had work to do, we were sick, our wives were sick, our mother-in-laws were dead—anything or everything to miss the moonlight.

This will show you the plan; if it was not one scheme it was another; we quarreled among ourselves, we abused our officers, we lied, we cheated, and we disfigured the golden rule till its own mother, if she could have seen it, would have wished it had died aborning.

But the judgment day came on apace, and the first case was Chronic's and the M. M. stopped his pay; there was hand-shaking and prayers and a feeling of relief; the wipers got cigars for *not* wiping extra clean, the M. M. got a gold watch, and men shook hands and were friends who had not spoken to each other for months. Why, before two days my wife went over to Jim Nixon's and borrowed baking powder and sassafras.

But the seed was sown and some of the weeds are here yet; we meet in the division room Sunday and talk about each other—talk about engineers when we ought to be talking about engines.

Look at our Grand Lodge; it is run, and has been for years, to satisfy a lot of men who wouldn't be satisfied with King Solomon for grand chief and the Queen of Sheba for inside door slammer. They met a few years ago, and one man who wanted a grand office found out that there was a smarter man running, who was not there—he at once schemed through a law preventing any member not a delegate from holding office; then the companies got to picking out our best and smartest men for master mechanics, traveling engineers, foremen, etc., so some more cranks put through a law preventing a man from being a delegate who was not actually running an engine—barred all our best men out. Then they barred out men who belonged to the firemen, so that now our annual convention is composed principally of men able to compete for our premiums on ignorance—figuring on being a delegate this fall myself.

Now I heard the other day that the Baldwin Locomotive Works had issued an order that the men would hereafter be required to buy their own chalk, slate pencils and file handles. I hope this isn't so, but I'm afraid it is, and if it is the blame can be divided up about equal between the men and the company. Such an order was no doubt called out by the wanton waste of this material by a few men—here the men are to blame. Instead of punishing 2,000 workmen and belittling itself, the firm should have hunted up the real offenders and made a burnt offering of them for the benefit of the rest—for not doing this the management is to blame.

The engineers of America have harbored too many excuses and incompetents who have hurt the reputation of the order; we have asked too many unreasonable things, we have had too many grievance committees stalking up and down the land seeking whom they might devour, and we have sent for Pete Arthur so often that there is not a big company from Hudson's Bay to Jehrico that will listen to us, right or wrong, and P. M. has about as much influence as I have.

I told you I was a kicking and I ain't half through—I'm loaded for bear, but I suppose you will choke me off along here somewhere, and so I quit. But I want to go on record as shouting in a loud voice, and telling some of our high and lofty legislators that there is a short rail just ahead of us, our road-bed is run down, bridges rotten, equipment old fogy—but nickel-plated, and looks well at a distance; but, no matter how we look to ourselves, we are not a going to make much of a record with the public unless we get rid of our old hook-motion ideas and modernize a little.

We have got a parallel road side of us now, new layout complete, young, progressive officers, enterprising, modern—72 inch boiler, 175 on the gauge, plain paint but a new, first-class machine—and we have got to equal their service, become second hand, consolidate, or be leased for 99 years for side track and repair yards.

Bless you, my dear sir, it is 11.81 that little Alexander is popping off at 180, with only a flutter in the lower gauge; and judging by the sound of the exhaust from the back bedroom Mrs. A.'s nightmare is trying to pull a full train on one side; the "gurril" has just come in and all is well, and so I go—not like the galley slave, scourged to his dungeon, but strengthened and sustained by an unaltering faith (that I have told you the truth) I can seek the spiral feathers of me downy couch, wrap a wire screen about me and lay down to pleasant dreams.

JOHN ALEXANDER.

Some Northern Pacific Roundhouse Kinks.

Editor The Locomotive Engineer:

I notice in your March number of 1889, devices for pulling cellars, and spring remover, and send you a rude sketch of tools used for that purpose up here on the N. P. R. R. Spring puller, cellar puller, and a crosshead mover. (Figs. 1, 2, 3.)

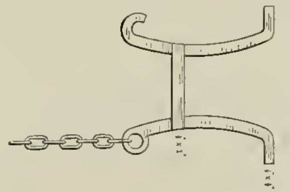


FIG. 2.

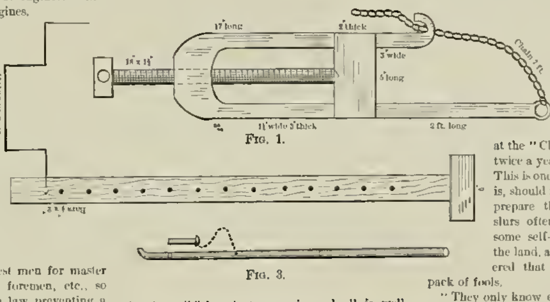


FIG. 1.

FIG. 3.

The spring puller is used by placing the fork over the spring and the frame, and securing as close as possible with the chain, then tighten by the screw.

The cellar puller is a very simple one; you hook the points into the bolt holes, throw the chain around the hook on the other side, pass it through the other side of engine where you can get at it, and the harder you pull the tighter it holds.

The crosshead mover is simply a flat bar with a head, to place against the cylinder, chest or guide yoke, and has, near its other end, a crooked iron hoop, as shown; this is so shaped that it will hook through or over any style of guide, and support the bar. With the lever the crosshead can be moved easily by inserting the fulcrum pin in the best place. The pin is chained to the lever, to prevent its being lost.

H. SUNDERLAND,
Roundhouse Foreman.
Little Falls, Minn.

From Wisconsin—Some Practical Obstructions to Debating Clubs.

Editor The Locomotive Engineer:

I admire the ideas of J. H. Davey, expressed in May issue of your paper. The Norfolk Debating Club may well be proud of its progress, and of Mr. Davey. You remark they followed your suggestions when they laid the foundation of their "Club." I will add that they have also copied after the N. A. S. E. (stationary engineers), who frequently listen to similar papers by men of Mr. Davey's stamp. Others help out with blackboard drawings; and conclusions drawn from such explanations are easily understood by all. The benefit of this is well known, but how to bring it into general adoption on railroads is a leading question.

A locomotive engineer said not long ago, "The company don't use us as good as street-car horses. Horses eat three times a day, and we don't."

Do men feel much like attending a Club meeting when they are living on ten square meals and part of three nights' sleep each week?

The companies hire men to man their "loco's" *and pull the cars!* No matter how much a man may say and explain at a "Club" meeting, if he can't get out of bed about midnight and pull a "full train over all the hills," and make time in a cold, blinding rain, and do all this for fifty miles on an empty stomach, he is "N. G."

He must buck snow when it is as high as telegraph wires, at the same time protect her crown sheet and "spring no pins."

Davey's ability ought to count for something, but R. R. Co.'s want these other things done, regardless of *meals, sleep or bad weather*, and if a man can "get there on time" with a full train, silence from headquarters is an "O. K.," and this engineer has convinced some one that he knows something. The company would never acknowledge any attempt he might make at the "Club," even should he be once or twice a year get rested enough to attend. This is one side of the question; the other is, should not enginemen in this country prepare themselves against insulting slurs often cast at them? Frequently some self-appointed cuss goes through the land, announcing that he has discovered that the American engineers are a pack of fools.

"They only know enough to pull her out and shut her off," etc., etc. With sufficient rope these missionaries have always hung themselves; but R. R. engineers ought to prepare against such attacks. Talent and good conduct oft times bear good fruit, but more frequently the biggest sucker about the office will get to the front, if he never was seen under his engine, which may be about to fall down.

"The Club" has little attraction for a train man who has been on duty for 71 hours continuously. Time cards are seldom made out to suit the meal hours of the men, compelling them to live for weeks on lunches.

Several of your correspondents are discussing whether it is better to run an engine in the company's notch or the center. You mentioned some time ago that there was in every locomotive a point that could be found for "throttle and lever" where she would do the best, and seem to work with less effort. That ought to settle it, for every engineer of experience knows that it is so.

I think we could profitably discuss the question of shutting off an engine coming into a station. I fear steam is often worked too close to stations, this is wasteful of steam, and dangerous for brakemen on top of train, in a cloud of black smoke. Engineers will often, in making a pull out of a side track, work steam till brakes have to be set to give hind man who has closed the switch a chance to go on same train. This is wasteful of fuel, wears out a train crew, and often adds to the danger.

LENNOX.

The second paper on Indicating Locomotives, by Cyrus F. Richmond, will appear next issue; it was received too late to get engravings made for June.

LOCOMOTIVE ENGINEER.
DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN, LOCOMOTIVE MAINTENANCE AND REPAIRS.

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CONTENTS.

A New Name.

The Fireman's Brotherhood is composed of engineers, firemen and hostlers, and, in many lodges, there are as many engineers as there are firemen, so that the name, Brotherhood of Locomotive Firemen, is misleading and unsatisfactory.

The *Magazine*, official organ of the order, proposes a change in name to Locomotive Enginemen, Locomotive Men, or some name that will cover the three classes entitled to membership. Locomotive Enginemen is a little cumbersome, and is as much too broad in its scope as Firemen is too narrow; and Locomotive Men might reasonably include machinists and wipers.

We are inclined to think a change would be beneficial if a good name were selected. A quarter of a century ago, when the engineers' brotherhood was organized by W. D. Robinson, he called it the Knights of the Footboard; but some influence, with a love for long titles, soon got it lengthened into Grand International Brotherhood of Locomotive Engineers.

While we believe in leaving knights to the chess board, the queen's garter and the history of the sixteenth century, there is something modern, inspiring and fitting in the word "Footboard"; it is the deck of the locomotive, where the engineer, the fireman and the hostler stand while on duty, and where no other employe does stand; it covers the three classes entirely, and includes no outsider, and as these three co-employes are brothers, why would not "Brotherhood of the Footboard" cover them all, and be pre eminently the proper name?

Let the Firemen's order become the Brotherhood of the Footboard. Let them preserve, respect and live up to their grand motto of Benevolence, Sobriety and Industry. Let them disband their grievance committee, and thereby two-thirds of their grievances, and put their striking power into the hands of the grand officers.

Let them establish higher standards of membership—expel men for drunkenness before, rather than after, they have been discharged by the master mechanics. Let them establish lodge-room discussions, buy books and models, seek instruction, court examination, and offer to railroad companies better posted, better selected and more reliable men from the ranks of the order than can be secured outside of it, and they will have found a practical solution of their dream of federation; for in ten years the Brotherhood of the Footboard would soar above orders with any other foundation, just as an eagle soars above a toad.

Federation and Insurance.

We have been asked to state our objections to federation, and why we consider it best that the engineers, firemen and other employes of the operative departments of railroads should not pool their issues and stand as one body on all questions concerning the service, also our opinions of assessment insurance.

We want to say right here that we do not object to federation; if it could be brought about it would be a grand, good thing—so would the millennium.

We advised against attempting a broad application of the scheme, because we were satisfied then, as we are now, that the parties to the contract would not "stay."

The engineers believe that they have an organization of their own that is better than all others, and hence object to their members belonging to any other labor order. They grant no favors, and ask few—unless they are in a tight pinch. It is not to be hoped, judging by the past, that they will consider other orders and stand on an equal footing with them. This fact alone makes a big hole in the proposed ranks of the federated army.

The bringing into one body for an aggressive defense of "rights" of conductors, brakemen and switchmen, with enginemen, brings too many interests in conflict.

There will soon be a flourishing order of conductors whose laws are like the rest of the railway orders, and whose members will not be encouraged by their grand officers to lower their standard of manhood and offer their services in places they are not fitted for, or capable of filling.

We would prefer to see all the independent orders pass laws prohibiting members from performing any duties of other employes on strike. We would prefer to see each order give the weight of their endorsement to each other when asking for fair pay, or protesting against a reduction—not declaring that one class of employes were receiving pay due another class.

We would like to see all grievance committees disbanded, and the settlement of grievances placed in the hands of the officials of the orders.

All this would be one form of federation, but an independent kind.

The Brotherhood of Locomotive Firemen are presenting the most arguments, and making the initial moves in schemes for federation, and in so doing prove that their motives are unselfish and in the interest of the whole body of men in the service; for, of all the orders, the firemen have the least to gain and the most to lose by any change in the existing order of things.

The firemen are the men who—if they would take them, which they never have—get the places of the engineers in case of a strike, and a higher rate of pay. They are the young fresh blood; they get a year's experience as firemen, pay a good initiation fee, are examined by a physician, and insured in the order; they pay their assessments a few years and become engineers, join the B. L. E., and, by its laws, withdraw from the firemen. This keeps the firemen's order full of the youngest, most vigorous and recently examined men, and withdraws them from the insurance before they get old, making the firemen's the only safe and successful insurance on the assessment plan. In all other insurance schemes on the assessment plan, every benefit paid where the beneficiary has not paid in the full amount creates a loss that must be disastrous in the end if all the insured members stay in the swim.

The firemen take in a safe subject, assess him for a few years, and then he is drawn out, having paid in something and drawn out nothing.

The engineers would be the gainers by federation, but, as they will not see it that way, there is no use in hoping for any action on their part.

There is no more reason for any ill-feeling between the engineers and firemen than there is between a father and son. The orders should be together under one head; their interests are identical. Proposing federation between them is like leading a horse to the spring; making them federate is like forcing the horse to drink when he don't want to.

The Tsar and His Serfs.

Both the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen have been complimented by the delivering up of the charters of all the divisions and lodges on the Reading Railroad. Men who will surrender every vestige of manhood and independence, and conduct their private business to suit the whims of such men as the Reading officials can best serve any order by getting out of it.

The Reading Railroad, from top to bottom, from first to last, from the men at the mahogany desks in the general office to the coal-pits, where half naked Huns toil from sun to sun for a pittance of 60 cents, is manned—in the main—by such things as these.

The Reading officials demand for their service men who dare not look up and say they are free and independent men; to be sure there are a few who will, and who defy the autocrats who would disrobe them of their manhood; but the great majority are the kind of clay that fall down and lick the sweat off their master's belly, and then swear it is holy water. The service of the road shows it, their shops show it, their reputation shows it, and their business will show it.

We have not so far lost faith in human nature as to believe that people will continue to patronize a road conducted upon such principles, by such excuses of men, under the orders of such slave drivers as openly declare that they want no one in their employ except that they surrender soul and body to the service of the company.

These are not the first individuals invested with a little brief authority who have tried to make money by injustice, oppression or force, and by outraging every sense of right, justice or humanity. Pirates used to do so, but they finally got to the end of the string. Public opinion, like the mills of the gods, grinds exceedingly slow—but it eventually gets there. In the case of the Reading it is long over-due, but it is thundering down grade—and the brakes are beyond control.

While we can hardly find language strong enough to condemn railroad officials who oppress the men under them for not conducting their private business to suit them (the officials), we have very little sympathy for the Reading men; they have not the requisite manly independence to make good Brotherhood men—or hardly good citizens. When the Knights of Labor trouble came on there, two years ago, the Engineers' Brotherhood offered themselves for service (with the approval of their officers), and became the tools with which the officers of the road knocked out the Knights; last year, when the "Q." trouble came on, the Reading Knights "got even," and, the officers of the corporation, seeing that they could pit the one against the other, did so—and then fired them both.

By this process the Reading will be able to keep their men just where they want them, and, as we said in the first place, the orders are to be complimented on getting rid of them so easily.

Some Finances of the Q. Strike.

Wherever we go we hear complaints from Brotherhood engineers about the manner in which funds were distributed during the C., B. & Q. strike—dissatisfaction, uncertainty and suspicion. During that struggle, the B. L. E. received and paid out between $800,000 and $1,000,000, as fast as received at the general office, it was sent to the front in big blocks, and receipted for in bulk by the chairman of the committee in charge; he may have paid every dollar out to the men or kept half of it, no one knows but himself—suspicions are rife. The engineers should not blame the chairman, right or wrong; it is their own slip-shod way of doing business that is to blame. They can well learn a lesson in correct business methods from the firemen. When the strike commenced, Grand Secretary and Treasurer Debs took it upon himself to keep the finances straight; he prepared a pay roll for every lodge that had men in the struggle, and every month sent these pay-rolls to the lodges, with a draft for the total amount; the officers of subordinate lodges verified every name on the rolls, and paid each man his money, taking his receipt therefor, so that to-day there is in the Grand Lodge office a receipt for every dollar of the $459,000 that they expended, by the men who got it; there was not a dollar lost or wasted. It was worth thousands of dollars in money and existence itself in harmony and confidence to the B. L. F., to have a man in charge of the great seal, and the combination to the safe, who knew how to meet the emergency when it came, and carried the financial part of the programme through without the loss of a penny or the breath of a suspicion.

The Fireman's Magazine.

A bound volume of the *Locomotive Fireman's Magazine* for 1888 is before us. The volume is bound in morocco, gilt edged, and handsome. Editor Debs has the reputation, not only in his own order, but among railroad men in every part of this great country, of saying just what he honestly thinks ought to be said, regardless of who it pleases or displeases. Careful not to wrong any man, he fearlessly defends the right, and denounces the wrong, without caring who is hit or missed, so long as it is the right ones.

The *Magazine* is the best family magazine published for railroad men; it contains ringing editorials on the live subjects of the day, of interest to the head of the family, and giving advice that can be safely followed; it has an interesting mechanical department, in which practical railroad subjects are discussed, and a woman's department, equal, if not better than that of any metropolitan magazine.

Presuming that bound volumes are for sale, we would say that no one interested in labor subjects can afford to miss the chance of preserving the honest, able and eloquent opinions expressed in the editorials of the *Magazine*, from the pen of so fearless a champion of right as Eugene V. Debs.

Proportion of Flue to Grate Area.

On some of the 8-wheeled passenger engines on the O. I. & W., that M. M., King has lengthened out, he experimented a little with flues. He had plenty of room for 200 2-inch flues, but did not believe that so many were necessary or desirable. He put 200 in several of the locomotives, however, and in several others he put but 150. Engineers and firemen report no perceptible difference in the steaming of the engines, while the ones with the fewer flues carry their water better, while in repairing there are 50 flues less to calk or replace.

Flues, as heating surface, do not begin to be as efficient as the same surface in the fire-box, and many mechanics believe in putting in only as many as will carry off the smoke and gases from the fire. A rule that has given good results is to make the area of flue opening equal to one-eighth the grate area.

With fewer flues we have more water in the boiler to draw our supply of steam from.

Making Fast Time.

The new ocean steamship, City of Paris, arrived in New York May 8th, having made the trip from Queenstown in five days, twenty-three hours and seven minutes—the fastest trip on record by nearly three hours—the best day's run being 511 miles; this is but $21\frac{7}{24}$ miles an hour.

This shows the importance of steady work, and keeping at it, for getting any place.

Half the roads in America can and do run trains at and above 50 miles per hour in places, but the constant stopping and slowing down soon bring the average record of 3,000-mile runs pretty close to average ocean travel.

If ocean steamers had to stop as often as freight trains, sailing vessels would beat them across the great salt lick.

During a recent visit to Troy, N. Y., we visited the rooms of the Y. M. C. A., maintained especially for the railroad men. The building was built especially for the purpose, is located next to the union depot, and is under the care of men especially trained for the work.

There is an ample reading-room, well supplied with books and papers, writing material, etc.; there is a separate room for card, chess and checker playing, a very large gymnasium provided with upwards of a hundred different exercising devices, a bowling alley, bath-rooms and bed-rooms. All these privileges can be enjoyed by any railroad man at an expense of but $2 per year. Such places are doing much good in providing a wide range of entertainment and exercise for a class of young men especially exposed to evil temptations.

There is no excuse for not reading up current literature, writing home, keeping clean, and developing the muscles, when all the cash it costs a man is four cents a week.

The suggestion of our correspondent, Lennox, as to using a blackboard in discussing locomotive subjects, is a good one. A blackboard can be seen, and a few rough sketches often explain matters wonderfully.

Books Received

SAFE RAILWAY WORKING. By Clement E. Stretton, C. E. London, Crosby, Lockwood & Co.

This volume, of 300 pages, was issued in 1887, and is a treatise on English railway accidents, their causes and prevention, and contains numerous illustrations of devices in use in Great Britain for safety to trains, including cuts of the prize car couplers, the Westinghouse and vacuum brakes, and a complete plan of the best and most successful signal systems—these are shown in large colored plates.

In England, when any accident of importance occurs, there is a board of trade investigation, and the fault has been many times fixed upon the trainmen, and severe punishments meted out; the injustice of many of these trials are shown up in the book, and faults of equipment placed where it belongs. Mr. Stretton is now employed by the Association of Engineers and Firemen to attend these trials, and see that they are given no more than they deserve. The price of the book is not stated, but it would be of service to any student of practical railway subjects.

The Syracuse Tube Co. are again running their mills full time, having settled their labor trouble.

ASKED & ANSWERED.

(20) J. C. Hess, Connemaugh, Pa., asks:

Will you kindly give through the columns of THE ENGINEER the dimensions of the cylinders of the Corliss engine used in Machinery Hall during centennial? *A.*—Bore, 40 inches; stroke, 10 feet.

(21) S. S., Kokomo, Ind., asks:

Have chilled valves or seats ever been tried, and with what result? *A.*—Some years ago there were a good many experiments of this kind tried throughout the country. We understand that the expense of dressing and finishing the chilled surfaces, and their tendency to crack, prevented any great success in that line.

(22) C. S. C., Milwaukee, asks:

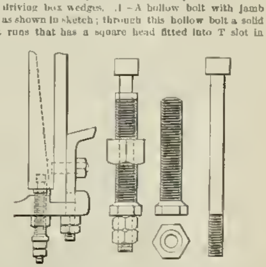
Did not the old Lawrence locomotives, built somewhere in Ohio, many years ago, have a cut-off valve on top of the main valve, substantially as used in many modern stationary engines? *A.*—We do not know of the valve gear of the locomotives mentioned; but independent cut-off valves were in common use on many builds of locomotives thirty years ago or more. A very efficient cut-off of this class—that built by the Norris Locomotive Works—was shown in the February issue of this paper.

(23) Ignoramus, Raton, N. M., asks:

1. Why will an engine slip going down hill, running in forward motion, especially with bad rail? 2. Will an engine flatten her back driving wheel tires more than the forward when slipping, and the cause for doing so? *A.*—1. We do not know that a locomotive slips under these circumstances, unless using steam. 2. While all drivers are coupled, and, consequently, must all slip an equal amount, it is not an unusual thing to find one pair of wheels with tires worn more than the others: this is due to the difference in weight carried on them, caused by poor equalizing; those drivers carrying the heaviest load will wear most under the same amount of slip.

(24) J. D. K., Aurora, Ill., asks:

What device do they use on the Pennsylvania for holding driving box wedges. *A.*—A hollow bolt with jamb nut as shown in sketch; through this hollow bolt a solid bolt runs that has a square head fitted into T slot in



wedge; the wedge is adjusted to proper height by the large screw, then the internal bolt is drawn down firmly by turning nuts on lower end, thus holding the wedge from moving. The whole device is then locked fast to pedestal brace by the large jamb nut.

(25) R. A. B., Chillicothe, Mo., asks:

(1.) What makes an engine pound more taking steam on front side of piston than she does on back side of piston, when she has a loose driving box brass? (2.) Why does an engine pound more backing up than going ahead? (3.) Why does the tire wear more just ahead of main pin than any other place? *A.*—It is generally acknowledged by engineers that there is a difference in pound between the front and back, and it is explained in this way: When the piston is pulling the pin from the back center to the forward center, it pulls the box off the wedge, and the rod and piston are going in the same direction as the engine frame, only faster, and the knock on the front of box will be lighter than it will be when it is driven against the wedge from the front to back center, because the piston not only drives the axle back, but the momentum of the train shoves the frame against the box, producing a blow of greater intensity. It is something like striking a ball with a bat: when striking the ball when pitched *toward* the striker the shock is much greater than if the striker struck the ball in a manner to drive it in the direction it was already going. The angularity of the rod will also cause a slight difference in the intensity of the blow. (2.) In most locomotives, especially old ones, the backing motion of the valve gear is often distorted to keep the forward motion in good shape, and the uneven cut-off causes pounding when backing up. (3.) It has been found that tires often wear most at a point between the two pins when both pins are below the center; and the wear is accounted for by the fact that at this point the engine gives the greatest rotative effect to the wheels.

The Locomotive in America.

By William Barnet Le Van.

FIFTH PAPER.

The majority of American locomotives and cars have cast-iron wheels, the tread or face being chilled. The casting of chilled wheels is an extensive and peculiar branch of American iron-founding. The best mixtures of such irons as are at hand, or which may be procured, require often very protracted experiments and much skill for their determination. An iron is required which is not only strong, but will "chill" evenly and shrink but little. Few if any single varieties combine these qualities. Some of the strongest irons shrink three-sixteenths of an inch per foot. The "chill" (produced by pouring iron while in fusion into or in contact with an iron mould) should penetrate to the depth of about half an inch everywhere on the surface of the tread of the wheel, and should blend with the soft iron beyond it in such a manner as to leave no distinguishing line of separation. To guard against the strain produced by the unequal shrinkage of the hub or nave and rim of cast-iron wheels has been the subject of much ingenuity. The rim being thin, and being poured against an iron mould, contracts rapidly upon the still fluid hub, which in cooling subsequently, tends to tear away from the rim. When all cast wheels were made with spokes, the hub was divided into three separate segments, three slots or openings of half an inch in width each, running through the whole length and thickness. After the wheel had cooled, these openings were filled either with lead or with dowels of iron, and two strong wrought-iron bands were shrunk one upon each projecting end of the hub. The single and double disk or plate form being respectively adopted, these were variously warped, always with the object of accommodating the plate to the strains which came upon it in cooling. These forms have been the subject of something more than a hundred patents.

Mr. Asa Whitney's (of Philadelphia) plan was to cool the whole wheel equally in all parts. The wheels, as soon as they have taken their "set" after pouring, and while they are yet red-hot, are taken out of the flasks and deposited in deep pits of brick-work, previously heated red-hot, and where, all access of air being excluded, they are from three to four days in cooling, and must necessarily cool equally fast in all parts. This treatment so thoroughly provides against all internal strain in the wheel, that while an ordinary solid-hub spoke-wheel broke of itself on being cooled suddenly in the open air, a wheel from the same pattern, but cooled in the "annealing kilns," did not break, even after a ⅞ inch hole had been drilled through the width of each of five spokes, leaving only a film of iron of less than ⅛ inch thickness on each side of the hole. It had been supposed by many that the process of very gradual cooling would injure, if it did not destroy the chill. The result proves that the chill retains its hardness perfectly. It is believed that the peculiar arrangement of particles, recognized as the chill, occurs at the moment the iron enters the solid state—that is, on the "set" of the casting, and that no heat below that point, subsequently applied, can draw the chill—in the same manner that steel, hardened to one color, will not lose its temper at lower heat. The cast wheels for passenger cars cooled by Whitney's annealing process have each a single plane disk, stiffened with straight radial ribs on the back, and are about 33 inches in diameter and weigh about 450 pounds each. The truck wheels for locomotive tenders and freight cars are generally 30 inches in diameter and 500 pounds in weight. As before stated, they are cast of special mixtures of the best qualities of iron, the requisite conditions being great absolute strength to resist both sudden and progressive strains, and the property of taking a deep and uniform chill. But little of the cast-iron employed for wheels has a tensile strength of less than 15 tons per square inch; test specimens broke with a fracture, almost suggestive of fiber, and of a dark gray color, but when chilled of a silvery whiteness.

Chilled wheels run from two to six and even seven years, according to the traffic, before becoming so much worn as to require removal, representing a service of from 80,000 to 200,000 miles run, and their usual load is two tons each. Locomotive driving wheels of from 4 to 5 feet in diameter have been cast with chilled faces, thus requiring no tires, and chilled tires from 4 to 6 feet diameter and 3½ inch face have been extensively and successfully employed at fair rates of speed, say 30 miles an hour; but with the increased speeds of the last ten years steel tires are only now used for locomotive driving wheels.

The chilled wheels are all made of the disk form, their weight necessarily increasing into a ratio nearly as the square of the diameter. To overcome this, cast-iron spoked wheels were tried, but it was found that the chill was less hard opposite the ends of the spokes than elsewhere, and thus they soon showed flat spots; spoked wheels are therefore seldom made, except for driving wheels, which are not chilled, but are turned on the tread and a steel tire shrunk thereon.

Driving wheels, although cast usually to receive steel tires, require considerable care to prevent being strained in cooling. These wheels are made almost always with radial spokes. The hub must be solid, hence the rim is quite commonly divided by slots, into three segments, which, as the hub contracts, can draw towards each other without strain. In such wheels the counterbalances are cast whole with the wheel; wrought-iron dowels are inserted in the openings in the rim, and the tire then shrunk on, which thus binds the whole firmly together.

Many of the best cast-iron driving-wheels are now cast with hollow spokes; and sometimes even the main hub, and that of the crank-pin also, are cored out hollow. In such cases the rim is cast whole, the distribution of the iron in the hub being relied on to equalize the shrinkage.

SPARK-ARRESTER.

A spark-arrester is an appendage to the chimney of a furnace or boiler, and is designed to retain the sparks, fine coal, or coke-dust, etc., which would otherwise be carried up by the draught through the chimney, and discharged, to the danger of combustible objects and the annoyance of individuals, in the immediate vicinity. The necessity for spark-arresters arose with the introduction of wood-burning locomotives in 1830. For many years wood only was employed as fuel in America, and, as it produced great quantities of sparks, as annoying to passengers as they were dangerous to the freight hauled, and the barns along the line, much ingenuity was directed to the problem of separating and withholding them from the escaping smoke and steam; and the voluminous "spark-arresters" were very successful in this respect, while they gave also an individuality to the locomotives.

There is no peculiarity in the adaptation of the engine to burning wood, as compared with that for burning coke or coal, excepting that the blast-pipes are smaller in the latter, and in the former the spark-arrester is applied to arrest and retain the sparks.

The spark-arrester is peculiarly an American institution, and possesses but little practical value beyond that derived from American practice.

One of the earliest, and, as experience has proved, the best arrangements for the purpose, is that known as the "bonnet-pipe" shown in Figure—

An inverted conical deflector, having a rolling edge like the rim of a tea saucer, is placed a few inches above the mouth of the ordinary chimney. This deflector inverts the draught, the sparks by their weight remaining in the bottom of an annular casing outside the chimney, whilst the steam and smoke rise and pass off through a wire-cloth screen, or bonnet, at the top. This form of spark-arrester was applied by William T. James, of New York, to a locomotive built by him, in 1833, for the Baltimore & Ohio Railroad; but it was not generally adopted until 1837. This form of spark-arrester is still extensively used for wood-burning locomotives, but in locomotives using bituminous coal has given place generally to the modification usually termed the "diamond" stack, in which the cone and netting are retained and the outer casing reduced in dimensions. The diamond stack, with various modifications of detail, was in use to a greater extent than any other up to about 1880, when the extended smoke-box system began to come into general use. This form of stack was patented by John Thompson, of Boston, May 29th, 1860, upon the theory that the sparks would "pass out of and beyond the current of smoke, so as to be deposited in the box by the action of gravity, and not carried up the chimney." It proved a failure, and has been since improved on by Hovey, Hill, and others. In the writer's judgment it is wrong in principle; the error lies in *expanding* the capacity of the smoke-box, the dimensions of which, in the ordinary construction, are too great.

BOILER.

The standard four-coupled American passenger locomotive boilers burning anthracite coal are of the type known as the "wagon top," the shell or barrel and fire-box casing being united by a long, tapering ring. The rings being oval in cross-section have to be strengthened. The usual and best way is to rivet to the flat places on each side of the tapering part, heavy **T** pieces. The diameter of the cylindrical part of the boiler is about 50 inches, and the thickness of the plates ⅜ inch. The total length of boiler from end to end is about 20 feet. The material used for the boiler and fire-boxes is steel, the ultimate standard test of which for tensile strength is 60,000 pounds per square inch—a slight excess or diminution in this strength causing a rejection of the plate, especially if the elongation falls below twenty-five per cent. in a piece twelve thicknesses in length from a test strip cut off by the maker from each plate, which is marked in such a position that a part of the mark remains on the plate and a part on the strip. Beside the test for elongation and tensile strength, a strip is also bent double while cold, untempered, and afterwards tempered. The grate is formed of tubes *two* inches in diameter, and are placed three inches apart from center to center, one of the tubes is left out, a solid bar put in its place and is termed a "dummy-bar," which is placed in the middle, and is withdrawn when hauling the fire. The flues are composed of about 160, two inches in diameter and about twelve feet in length, giving a total heating surface of about 1,000 square feet. Another set of two-inch tubes traverse the fire-box, they are attached to the front of the fire-box flue sheet about two feet from the grate, and, passing upward, are attached to the crown sheet about sixteen inches from the front fire-box sheet. There are four of these tubes in the width of the fire-box, and are attached to the fire-box sheet by screwed ferrules; on top of them are placed a number of fire-brick slabs three inches thick, extending from the tube plate up to within twelve inches of the crown plate. The fire-box stays are spaced about four inches apart. The stay-bars for crown-sheet consist of two bars one inch apart, ⅝ inch thick, and four inches deep, recessed slightly on the underside at the ends to receive the upper edge of the side plates of the fire-box. The stay bolts are ⅞ inch diameter, with square heads, the body of the bolt inside of the head being slightly tapering, and the hole in crown-sheet made to fit it. Between the top of the crown-plate and the underside of the stay-bar is ⅞ inch, and this space is occupied either by a brass distance-piece at each bolt, or by a washer. Similar washers are employed at the top of the bars. As before stated, the tapering portion of the boiler being oval, this part is stayed with three **T** bar stays four inches by ⅝ inch, the first one 2½ inches from the fire-box flue sheet and the other two six inches apart from center to center. They are riveted to the sides of the boiler through the sole plates at the end of each stay. Between each pair of roof stays a tie-rod ⅞ inch in diameter passes across the boiler and is screwed into and riveted to the shell, and every alternate roof stay is attached to the boiler by two braces, each consisting of a short link passing between each pair of roof stays, and pinned to the latter at the lower end, while the upper is connected to a pair of braces 2½ inches by ⅝ inch bolted to a double angle iron bracket riveted to the boiler shell. Where the steam dome comes, these braces are replaced by single rod 1¼ inch in diameter, forked at the lower end to receive the link, and riveted to the dome at the top by means of a palm.

Mr. Rogers was the first in America to adopt, and to establish by adoption, on the large scale of his own business, the present proportion of boiler for a given cylinder. He enlarged the grate area and heating surface liberally. He was the first to establish the six-foot wheel in general use for express

(*Continued on page 12.*)

REDUCING VALVES.

—THE—

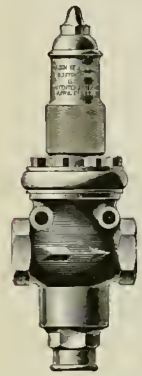
MASON REDUCING VALVE

—FOR—

CAR HEATING

is used by nearly all the leading railroads. It is also the standard used by the Martin, Sewall, Standard and Erie Car Heating Co.'s, who used 1,500 last winter. We guarantee it, and send it on trial.

AIR BRAKE GOVERNORS.



The accompanying cut shows our

NEW PUMP PRESSURE REGULATOR FOR AIR BRAKE PUMPS.

During the past year we have thoroughly tested them on engines of the Boston & Albany, Fitchburg, and several other railroads. They have not required a particle of attention during this time. We now guarantee them. As the air pressure chamber is entirely separate from working parts, any dirt in train pipe cannot get into working parts. Weight, 7 lbs.

We make these so that no extra fittings are required for applying to the air pumps on brake systems.

SEND FOR ONE ON TRIAL.

COMBINED REDUCING VALVE & TRAP.

This device has been put on the market for use on each car where it is found to be necessary to carry a pressure of about 40 lbs. on the train service pipe, and then reduce the pressure separately for each car for heating. This valve not only reduces the pressure, but traps the condensation, thereby avoiding the necessity of buying both trap and reducing valve separately. It is fitted with couplings, and occupies scarcely more than the space of a globe valve. **IT WILL NOT FREEZE.**

Any of above goods sent on trial by

MASON REGULATOR CO.,

10 CENTRAL ST., BOSTON.

In order to insure prompt delivery when the heating season arrives, we would request that railroads favoring us with orders, do so at earliest convenience.

passenger locomotives. He was the first to adopt the present form of boiler, the elevated crown of fire-box, the rounded corners and double domes. He established the link motion as a standard element, making it in its adjustments superior to any other valve motion, and in workmanship one of the best points in the American locomotive. He adhered to the outside connections, and placed the cylinders horizontally in all his engines; he improved on the previous cylinder fastening, making it both lighter and stronger. He was the first in America to insist upon and to practice the counterbalancing of the entire reciprocating parts; the first to thoroughly protect the cylinders and valve-chests from radiation.

The spread truck with center bearing was established in its most approved form in the Rogers locomotive. The expansion brace now used in al American locomotives for fastening the boiler was due to Rogers.

From the above it will be seen that while, up to 1850, there had been adopted many dissimilar patterns of locomotives there was since that period a steady assimilation of style, until in 1860 there became in America one well-recognized standard of locomotive, not only for a single class of traffic, but, indeed, for nearly all classes. This is the conventional eight-wheeled locomotive, with four drivers and a truck frame; and in its leading details there is an almost exact agreement in the practice of the different builders.

A One-Dollar Library.

The writer recently met a young fireman who had served in that capacity less than two years, and on a smdl road. He asked a number of questions about sight-feed lubricators and air-brakes that convinced us that he was pretty well posted on these devices, and we wondered at it,,as neither device was in use on his road. A little questioning developed the fact that he got his information from circulars of the manufacturers.

The writer spent an hour in this young man's room, and there inspected his "library"—which he laughingly called it.

This young man is away from home, but supports his mother, and has all he can do to make both ends meet; but there is something in him besides days' work, and we feel sure that he will eventually make his mark.

The only ornament in his room is a picture of his mother, and beneath it the words, written by himself: "To love, honor and obey." There is a beacon light that will keep him off the shoals that wreck the lives of so many young men.

On the table there were well-worn copies of Forney, Sinclair, Alexander's Ready Reference, and a time card. On a shelf, two years of the *Fireman's Magazine* were piled up, all the copies of THE LOCOMOTIVE ENGINEER, and a few odd papers he had bought from time to time. In his trunk was the "library," and it was arranged and classified in good shape, all matter on a subject being together.

He said that he set aside $5 per year for papers and books—could not afford more—and when he saw a new device mentioned that was in his line of business, he sent for circulars if he could not find them around the office of the master mechanic.

He had quite a collection, and had made good use of them. Said that he got a good deal of information from them, and that the whole "library" cost less than a dollar. He knew more by far about the details of the air pump than does many a fireman who has sat within hearing distance of one for three years—and was deaf—and more than some men who are daily handling the 3-way cock, and making passengers sea-sick.

Our English Brothers—Real "Twins."

We are indebted to Clement E. Stretton, C. E., Leicester, England, for copies of the *Association of Locomotive Engineers and Firemen's Monthly Journal*, published at Leeds.

This association is a sort of a combined brotherhood with benefits. There are regular entrance fees and monthly assessments, and benefits are paid for accidents, sickness, death of member's wife, old age—according to length of time a member—legal defense, discharge, allowance while suspended, and if a delegate is reduced, his pay is made good till he is restored; if discharged he receives £100 ($500), and fifteen shillings per week while seeking employment. They evidently do not intend to let their delegates be discharged. They employ a consulting engineer and a firm of solicitors to protect them, and see that justice is done them in all investigations of wrecks, etc.

Their prospectus states:

"The objects of this society are to form funds, by entrance fees and weekly contributions, for the relief of its members in sickness, incapacitation by old age, or accident, from following their profession or calling, by paying a sum of money at death of members or their wives, and for the relief or maintenance of members when on travel in search of employment, or when in distressed circumstances, and to advance the interests of its members in their various professions and callings, by procuring a reduction in the excessive hours of labor, regulating the speed of trains, the adoption of modern improvements for the general safe working over all railways in the United Kingdom, and generally in such other manner and to such extent as the executive committee may determine.

"Those men who do not wish to join for full benefits, may join for trade purposes only."

The *Journal* is a 32 page magazine, and devoted to the order and its members. We are glad to place it on our exchange list.

A Direct Guarantee for Journal Bearings.

The well-known manufacturer, D. A. Hopkins, has now under way at his factory, journal bearings to equip 7,500 cars, for which his bearings were called for in the specifications under the terms of a peculiar guarantee. It was agreed between Mr. Hopkins, the car builders and the company for which the cars were being built, that Mr. Hopkins should be directly responsible to the road, and not to the car builders, for the performance of the bearings in service. The plan has the advantage of enabling the railroad to put its finger directly on the guilty party, if the bearings prove unsatisfactory.

The *Railway Register* and the *Northwestern Railroader* are fixing up some changes in railway terms for use both in England and this country; they propose "station" for "depot," "stoker" for "fireman," "car" for "carriage," and "*locomotor*" in place of "engine driver" or "engineer." There is about as much sense in calling a locomotive engineer a mocolotiveer executioner, a locotitioner or a billy-goat, as a locomotor. If any change were possible from the English "driver" or the Yankee "engineer," it should be "locomotive runner," or simply "runner," much used by the men themselves; but even that would be hard to grind into use.

THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. VII. NEW YORK, JULY, 1889. $1.00 per Year. or 10c. a copy.

Compounds.

While the compound locomotive now at work on the Pennsylvania is awkward and uncomfortable to our enginemen, it is acknowledged by all that she does do well on a long run, has made up time on the runs between this city and Philadelphia, and burns on an average two to three tons of coal less than our standard engines on a round trip. There is, no doubt, some economy in the compound system, and when a locomotive of good design, adapted to our service, with but two cylinders, and arranged to use high pressure steam in both at will, is put on trial, it will, we believe, meet with success. A cast-iron man could not stand to ride the Webb over our rough tracks.

Historical Locomotives.

EIGHTH SKETCH.

The locomotive shown on this page was one of three remarkable little engines that had a great deal to do with the reputation of American-built machinery abroad.

They were extra finished models, one fourth actual size, made at Philadelphia, Pa., by William Norris, founder of the locomotive works that bore his name, and one of the most progressive and enterprising designers and builders of locomotives during the first thirty years of their use on this continent.

One of these little locomotives was presented to the Emperor Nicholas of Russia, one to the Archduke Francis, father of the present Emperor of Austria, and one to Louis Philippe, king of France.

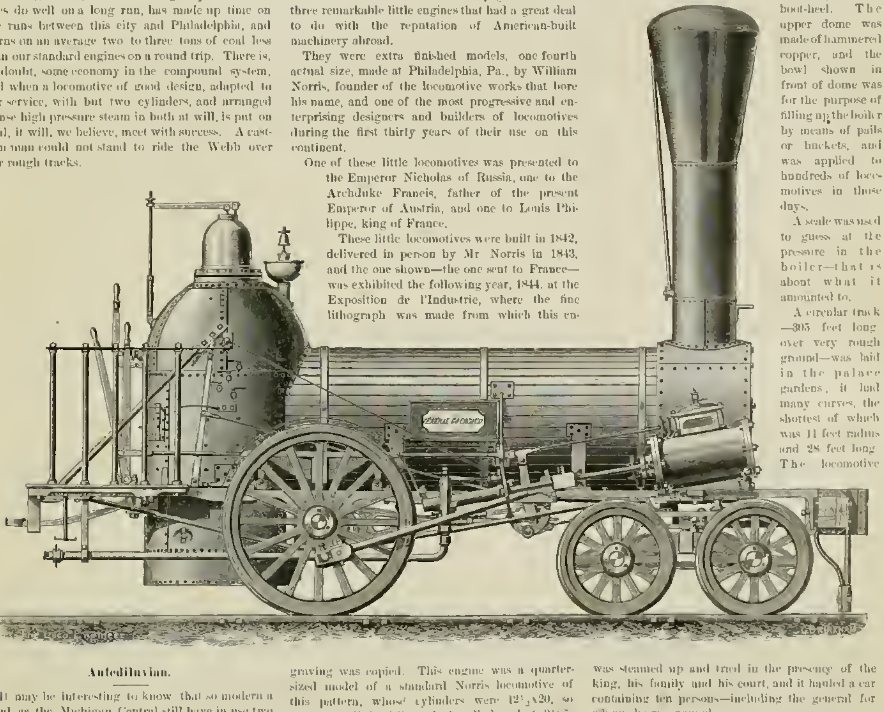
These little locomotives were built in 1842, delivered in person by Mr Norris in 1843, and the one shown—the one sent to France—was exhibited the following year, 1844, at the Exposition de l'Industrie, where the fine lithograph was made from which this engraving was copied. This engine was a quarter-sized model of a standard Norris locomotive of this pattern, whose cylinders were $12\frac{1}{2}$x20, so that these little fellows had cylinders but $3\frac{1}{4}$x5. The guides were round bars, the valve motion being the drop hook, full stroke, plain valves were used, and no provisions made for cutting steam off short. An extension of the valve stem went to the cab on each side, and connected to "starting bars," both being arranged on the right side of the foot plate—it was before the day of cabs. These levers worked all the time when the locomotive was in motion. Drop hooks were used, the reverse lever, which is shown in front near the gauge cocks, merely rocked the U-shaped tumblers shown just under the rocker arm, each end of these U's carried a roller that supported the hook, and when one end lifted up the go-ahead hook the back-up hook dropped down and was "hooked on" by moving the rocker by means of the starting bar in the cab. The boiler was what was known as a "dome boiler," and had a half-round fire box—the shape of a boot-heel. The upper dome was made of hammered copper, and the bowl shown in front of dome was for the purpose of filling up the boiler by means of pails or buckets, and was applied to hundreds of locomotives in those days.

A scale was used to guess at the pressure in the boiler—that is about what it amounted to.

A circular track—305 feet long over very rough ground—was laid in the palace gardens, it had many curves, the shortest of which was 11 feet radius and 28 feet long. The locomotive was steamed up and tried in the presence of the king, his family and his court, and it hauled a car containing ten persons—including the general for whom she was named.

It was the first time that a locomotive had been tried in France on uneven ground—such as would be encountered in building across country—and proved the claim of the American designer, that no such expensive permanent way was needed as the then, French practice. King Louis extended to Mr Norris the thanks of France, invited him to establish works in the country and take charge of roads.

Quite a number of locomotives of this design were then ordered, and were built in the Philadelphia shops for the French Government, and the first one was named the same as the model—General Gourgaud—and was just like her, except that it was four times as large. The little locomotive



Antediluvian.

It may be interesting to know that so modern a road as the Michigan Central still have in use two hundred locomotives not provided with any kind of cab oilers, the firemen being obliged to go out to chests to oil. About twice per year a man is knocked off by the snow and killed. Inside oil cups are now being put on as fast as the engines are shopped—thanks to an intelligent railroad commission. Outside oilers have a right to a place in history, but not on locomotives in use to-day.

The Canadian Pacific's new moguls have lunch pail boxes in the roof of the cab over the gangway.

"Jack the Ripper" now carries a standard P. R. bell—the laws of New Jersey require it.

given to the Emperor Nicholas was as well received, and the writer has been allowed to read a letter from the chamberlain of the Czar, accepting the present of the distinguished American engineer who "prayed the privilege of doing homage to the Czar," and directing that he be presented with a "golden ring enriched with diamonds," a request to assume control of the road between St. Petersburg and Moscow, and granting Mr. Norris many favors and conferring many honors.

Our energetic countryman was not seeking a fat position in charge of a Government road, but a chance to introduce American locomotives. At the Court of Austria he was still better treated, and he was induced to establish large works in Vienna to build these locomotives, and was given charge of the Vienna & Trieste road—then the most important in the kingdom.

Mr Norris had these works running and turning out locomotives in 1847, but the opposition to "foreign ideas," and the intrigues of opposition works got him into a dispute with the Government over a lot of locomotives ordered from him, payment being refused after the locomotives had been in use for from six to ten months, until Mr. Norris became disgusted and quit the business.

He also established a large factory at Paris, and was about to commence turning out locomotives when the revolution of 1848 came on, depriving Louis Philippe of his throne, exiling him to England, and wiping out almost every form of industry, locomotive building with the rest.

While some of our earlier roads imported a few locomotives from England, Mr. Norris paid them back, for he went over there and took double the usual load for horses up the great Lickey inclines, a feat that was considered impossible with a traction engine—this exhibition secured him an order for twenty engines for that work.

He built 150 locomotives for Germany and Austria, also a number for France, Russia and Italy. This little engine deserves a place in history as showing the entering wedge of American industry, ingenuity and ability that was fast gaining the upper hand in European locomotive design and building, only checked and hindered by the shifting fortunes of war, and finally wiped out by the scourge of revolution and anarchy.

Indicating Locomotives.

By Cyrus F. Richmond.

SECOND PAPER.

There are several expert mechanical engineers who have written much about the indicator and its uses, and have done it so well that it would seem unnecessary for a junior at the business to attempt to give another description of it; yet I have found that a great many locomotive engineers and firemen have never given the subject attention. Some never heard of such a thing, too many of them are afraid it is beyond their comprehension, and skip by everything they see in a paper or book that looks like a shoemaker's last to them. To those who know all about the indicator, this paper may seem like a lesson in the "card class"—I mean the days of short pants—and I hope they will bear with me for the sake of some reader who has not had time or opportunity to make a study of this branch of engineering.

The indicator is an instrument for registering the pressure of steam in the cylinder of an engine throughout the stroke of piston. The figure registered is called a card or diagram, from which is computed the mean effective pressure; that is, the average steam pressure forcing the piston during the complete stroke one way, or in one direction, minus the steam pressure that holds it back.

Although there are several makes of the indicator, they are all constructed on one general plan, namely, a steam cylinder and a paper drum. The steam cylinder is so arranged when applied to an engine as to receive the steam whenever the engine receives it, thus forcing the small piston within, up, which, in turn, communicates a straight line motion to a pencil, which is made fast to an arm.

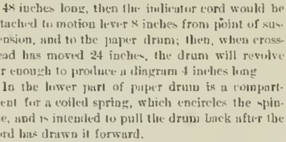
The movement of piston is multiplied by various devices, so that when piston has moved up but one-quarter of an inch, the pencil will move an inch. (I might add that the proportion is not the same in all makes of indicators, but this is immaterial, as it is only done to obtain a suitable size diagram with as little movement of piston as possible.) Above the piston is a spring of very high tension. They are made to some known tension, and numbered accordingly. The number of spring denotes the pressure of steam recorded when pencil has moved up one inch. For example, when a number 80 spring is used, it means that in one inch of height of diagram from atmospheric line there is 80 lbs. pressure of steam, and with a number 60 spring there would be 60 lbs. pressure of steam, etc.

An arm is attached to the outside of steam cylinder, on which is mounted the *paper drum*, which is simply a cylindrical tube or shell, so constructed as to rotate with the motion of piston in engine. This motion is imparted to it by means of suitable levers, and taken from the crosshead of engine, and is reduced to any required movement that is within the range of size of drum used. For instance, the movement of crosshead is 24 inches, and a diagram is desired 4 inches long, our motion lever is 48 inches long, then the indicator cord would be attached to motion lever 8 inches from point of suspension, and to the paper drum; then, when crosshead has moved 24 inches, the drum will revolve far enough to produce a diagram 4 inches long.

In the lower part of paper drum is a compartment for a coiled spring, which encircles the spindle, and is intended to pull the drum back after the cord has drawn it forward.

The paper, or card, as it is called, is wrapped around the drum, and held in place by a slotted bar, called a finger bar.

Now it can be readily seen that, with the pencil point touching the paper on this drum, and the



pressure of steam from cylinder of engine forcing the indicator piston up, which, in turn, communicates a straight line movement to pencil, and the drum being moved or rotated simultaneously with the crosshead of engine, a correct diagram of the steam pressure in cylinder of engine will be drawn on paper.

We will assume that the piping has been arranged, and indicator attached, as shown in the May issue of Locomotive Engineer, then, after paper is put on drum, we start the drum in motion by releasing the dog or ratchet, open the three-way cock just the least bit, and count the revolutions by the exhaust of steam from a little hole in the three-way cock. After some practice one will be able to count them correctly, by counting for 15 seconds and multiplying by 4, to obtain number of revolutions per minute. After this is done, close the cock and draw the atmospheric line, then turn the cock down and draw the diagram from back end, being careful not to allow the pencil to run over more than once, then turn cock the other way and draw diagram from front end of cylinder, then stop the motion of drum and take card off, write the time and number of revolutions, steam pressure in boiler, and the notch that the reverse lever is in on the card, and you have sufficient data to calculate the horse-power from. The size of cylinder and such data need not be taken into account until you have finished taking the cards.

Of course the shape of diagram will depend entirely upon the way in which the steam pressure in engine acts, for the indicator is in direct communication with it; so, if the steam were admitted at the beginning of stroke, and admission continued to the end of stroke, then exhausted, the figure would have four right angles, or be *square*, as some would say. In practice this is not done, so we will try to represent a diagram in which the steam is admitted at beginning of stroke, and valve closes when piston has moved but eight inches, exhaust taking place when piston has moved 18 inches. It must not be understood that this card was taken from an engine, as its purpose is to simply show what the various lines are called, and what we learn from their shape.

The straight vertical line, at the left of figure, is drawn on card to show the amount of clearance space filled with steam, and is called the *clearance line*. The distance from this clearance line to the beginning of diagram represents the space filled with steam, from piston—when at end of stroke—to the valve face. The straight vertical line in diagram is called the *admission line*, and its height, from atmospheric line, represents the pressure of steam in cylinder of engine at beginning of stroke. The horizontal line at top of diagram is the *steam line*, and in this case shows that steam was admitted to cylinder of engine while piston traveled six inches of its stroke, and was then abruptly cut off.

The curved line at top of diagram is called the *expansion curve*, and each successive height from atmospheric line represents the pressure of steam forcing the piston ahead, and, as it is losing its force in doing so, the pressure drops, consequently the pencil. It will be seen that, should the exhaust not occur until the piston had reached the end of stroke, that there would still remain considerable steam in cylinder, and this would tend to hold the piston back when making its return stroke; so exhaust occurs at sixteen inches of stroke, and we have another change in direction of diagram, and this line is called the *exhaust line*. Would say that in reality this line extends back to the admission line, for the exhaust does not close—in this case—until the piston has reached the end of stroke. But the bottom line is called the *back pressure* line, and its height from atmospheric line shows the amount of steam that remains in cylinder, and is acting against piston on return stroke. The line below the diagram is called the *atmospheric line*, and is drawn when there is no steam in cylinder, and represents the pressure above a perfect vacuum, which is 14.7 lbs. Would say that this line corresponds to the zero on steam gauge.

Origin of the Variable Exhaust.

Ross Winans, of Baltimore, patented in the '40's a variable exhaust nozzle, but had any amount of trouble in defending his patent, Wm. Norris, of Philadelphia, having built many of them before Winans' invention. We recently had the pleasure of reading over some old letters on this subject that passed between Mr. Norris and the Hawthorne Engine Company of England.

They applied it in 1839, and built most of their early engines with it, and furnished the drawings to Mr. Norris in 1842.

The opening of the blast nozzle was varied in these old engines by turning a hand-wheel that operated a bell-crank by use of a worm gear, raising and lowering a plug in the pipe.

A New Disease.

The new London & Northwestern Railway "racing" locomotive "Teutonic" has not proved such a brilliant success as was anticipated, as when it was attached to the 3.45 P. M. express from Crewe to Manchester, on Saturday week, it "jibbed," and could not be got to start, and subsequently had to be ignominiously taken back to its stable, and replaced by a "jumbo," which ran off with the train forty minutes late.—*R'y Herald* (London).

Say, neighbor, what is "jibbed"?

Master Mechanic J. N. Lauder, of the Old Colony, recently made the statement before the New York Railway Club, that to Wm. Mason and John P. Laird belonged the credit of spreading the forward truck. He put the time as 1852. There is little doubt that to Wm. Norris, of Philadelphia, belongs the credit of first spreading the truck wheels and placing the cylinders horizontal. We have before us a lithograph of a Norris locomotive, made in 1850, with this arrangement—this was before Wm. Mason commenced to build locomotives.

An Improved Drop Pit.

Any kind of a drop pit is an improvement over the old-fashioned "slings," still much used in the East, especially in New England, for removing driving wheels and trucks; and a good transfer jack is an improvement over a drop pit.

Wm. A. Foster, Supt. of M. P. and M. of the Fall Brook Coal Company's road, has devised and has in use in his shops at Corning, N. Y., a very neatly arranged and efficient set of hydraulic cylinders to do this heavy work.

Fig. 1 shows the general plan; two gauges of track are laid over a pit—one the regular gauge of 4' 8½", and another track with a gauge of 8' 9". On this track runs the trucks that are used in place of blocking under the locomotive after her wheels are removed. The drop pit itself is as wide as the widest track, and the rails across it for the 4' 8½" track are removable. In the center of this pit is planted the large cylinder, as shown in Fig. 3, and in detail in Fig. 4. As all sizes are given, no reference will be made to them, suffice to say that at 90 pounds of water pressure this jack will lift eight tons. A "pulling cylinder" is hung up overhead, as shown in Fig. 1, and by using one or both of the pulley blocks shown, a dead engine can be pulled back and forth over the pit at will, so that it is no trouble to place her in any desired position.

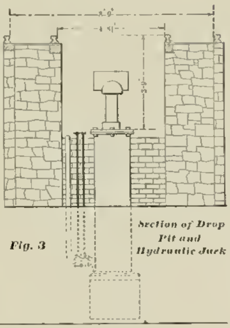


Fig. 3 *Section of Drop Pit and Hydraulic Jack*

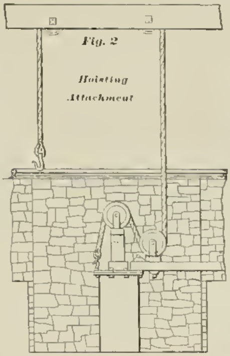


Fig. 2 *Hoisting Attachment*

Fig. 4

Fig. 5

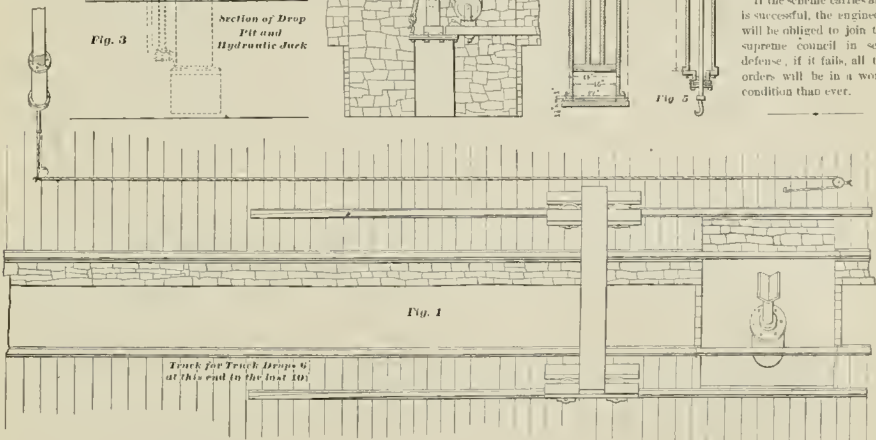


Fig. 1

When in position the big jack is put to work, and its forked head is forced up and embraces the axle in the center, the dummy truck on the wide track—which is slightly inclined—is run up under the load, the section rails over the drop pit are removed, and the pair of drives let down into the pit, the engine moved off of the pit, the wheels lifted, the rails replaced and the wheels rolled away.

By removing the V-shaped head, and placing a pulley on the piston, as shown in Fig. 2, a very powerful hoisting attachment is made.

The pulling cylinder, as shown in Fig. 5, is a very useful lift for lathes, planers and presses—it will lift two tons with 90 pounds pressure. The arrangement of water and exhaust valves is very plainly shown in Fig. 2, and, as all sizes are given in the drawings, a duplicate pit can be made without further drawings by any of our readers so inclined.

The details of this rig are so ingeniously worked out that two men can remove or replace all the drives and trucks under a locomotive with very little trouble and no exertion.

How to Set Non-Lifting Injectors.

On a very few roads they use non-lifting injectors only, and they give good satisfaction.

They are not so quick on the start as a lifting injector, but they are much simpler, cost less, and require less for repairs. They have another advantage, generally overlooked, and that is the fact that they do not fill up with scale as badly as lifters.

We all know that injectors scale up ahead of the combining tube—never at or back of the steam tube; this is because the heat deposits the foreign matter in the water upon the interior of the injector—just as a teakettle is coated on the inside with lime. When an injector is shut off it is hot, and any lime or other matter of a like nature is baked upon the interior by the heat.

Now, the non-lifter is below the water line of tank, and when shut off the overflow is closed, and it immediately fills with cold water, and there is very little, if any, deposit.

The main objection to them is this fact, that the overflow must be closed—it is often forgotten, and the water wasted.

One of the best posted men in the injector business proposes that the overflow pipe of the non-lifter be brought up above the tank level, so that it will stand full of water, then the instrument could be easily started, the overflow would be up where a man could see it, and the overflow cock would never have to be closed, except when it was desired to use the heater. We would say in this connection that the overflow cock should be so arranged that, when shut, it would open the bottom of overflow pipe to drain it, thus preventing a freeze-up.

The best non-lifters are now made so that the tubes can all be taken out without disturbing the pipe connections, so that repairs would be cheap, and the nuisance of a shower bath arrangement in the cab would be avoided.

Put a long overflow pipe on that left-hander that you never use, and see if it don't work as good as any other.

Federation.

Federation is an accomplished fact. The firemen, brakemen and switchmen are now united under one supreme council. The constitution is a secret one, but we have it upon good authority that it is a very fair one withal, and fully provides for every emergency. It will be a difficult matter to order a strike under its rules, and can only be done after several other expedients—fully provided for—have failed.

In our estimation, the only question of success in any scheme of federation is the loyalty and staying qualities of the parties to the contract.

That federation is right, goes without saying. This arrangement will deprive the engineers of the co-operation of the firemen in case they (the engineers) choose to strike, as they will remain neutral—not running engines as scabs—but firing their regular engines until called out by the supreme council.

The several orders remain intact, and use all their present machinery to settle their troubles, using the grand federated body only as a court of last resort.

If the scheme carries and is successful, the engineers will be obliged to join the supreme council in self-defense; if it fails, all the orders will be in a worse condition than ever.

In a run of 59 miles on the Bound Brook line, the "Strong" engine, "A. G. Darwin," took four cars over the line in 73 minutes. The same day a standard engine took the same load over the line in 65 minutes, burned less coal, evaporated less water, carried 25 pounds less steam, and weighed over 30,000 pounds less herself. The question is now being discussed, why the engineer did not let the Strong go.

The Pennsylvania Railway lost 33 locomotives in the recent floods at Johnstown, 27 of them have been recovered, but are almost total wrecks. The tenders, being light, were carried far below the locomotives, and are not worth picking up.

William Norris, grandson of the founder of the Norris Locomotive Works, has become interested in the American Supply Co., Kansas City, Mo. They can furnish everything from a spike to a trunk line.

The E. T. V. & G. are running a six inch single nozzle in their consolidations.

Ride on a Fast Engine.

The writer had the pleasure, on June 13th, of a ride on one of the new fast express engines of the N. Y. C. & H. R. R. between this city and Albany. Engine 677, Archie Buchanan, engineer, Fred. Schenider, fireman.

Angus Sinclair, of the *National Car and Locomotive Builder*, sat in a little dog-house in front of the left cylinder, and took indicator diagrams, while chief draftsman, Phil. Lonnergan, and the writer, took turns at collecting data and cinders in the fireman's corner.

The engine had seven heavily-loaded sleepers on the "special", time from New York to Albany, 3 hours and 20 minutes—an average speed of 42.9 miles per hour.

Engineer Buchanan is a remarkably even runner, making his time with very little manipulation, most of the distance being made with the throttle a little over half open, and the reverse lever in the fourth notch from the center.

At Hudson the train was delayed on account of a hot-box, and left there eight minutes late, seven minutes of this time was made up between there and Albany—28 miles—a speed of 59 miles per hour being made, with wide-open throttle and lever in fifth notch.

The engine is Mr Buchanan's latest design—is a heavy 8-wheeler 19x24, with a wagon-top boiler with smallest ring 63 inches in diameter. This locomotive steamed remarkably well, and rode better than any engine of her size we have ever been upon.

There is in use on this engine a steam jet to prevent the throwing of black smoke. The best smoke-preventer we know of is an intelligent fireman, and the young man on the 677 is of this class. The fire-door has a very large damper, and an inside deflector that also assists in the prevention of smoke.

Webb's Double-Barreled Boiler.

Mr. Webb, designer of the compound locomotive now running in this country, has invented, built, and put in service a new form of boiler, something on the Strong style—only worse.

He uses two fire tubes, entirely surrounded by water, but one is above the other, so that the back head of the boiler looks like an exaggerated figure 8. The fire door is between the two tubes, and the lower tube carries the grate, the hot gases return ing toward the fire door and going into the upper chamber—which serves the purpose of a combustion chamber—and into the flues.

The device has some of the heads corrugated, and is stayed only in the central part, where the two tubes are connected, and over the top tube, which is flattened on top and supported by crown bars, near the tube sheet.

The device abounds in Adamson joints, seams, and peculiar shaped throat sheets.

It is being tried on a "goods" locomotive, and will, of course, be a great success—such inventions have to be successes on the home road.

The excuse for going into this form of box is given as the high price of copper. The fact that steel boxes of enormous size are standing, and have for years stood 150 pounds per square inch in America, does not prevent the English mechanics from declaring it necessary to put it into different shape to make it a safe fire-box material.

Angus Sinclair recently indicated several of the big engines on the New York Central road. Strange to say, this is the first time an indicator has been used on this system. The indicator is as old as steam engines, and in every-day use in almost every branch of steam engineering; that it should be unknown upon one of our first and greatest trunk lines seems a wonder.

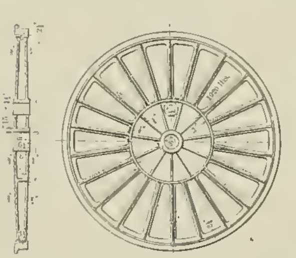
Every month we are obliged to leave over long letters intended for correspondence, this we very much dislike to do, but limited space compels it. We will ask our contributors to try and have all their say in articles not over two columns long—wait till winter; it is too hot to read five-act stories now.

One of the Earliest Cast-Iron Driving Wheels.

During a recent very pleasant visit to Isaac Dripps, of Philadelphia, we came into possession of the original drawing for the first cast driving wheels placed under the 8 foot wheel engines on the Camden & Amboy road in 1849.

This drawing was made June 14, 1848, by Mr. Dripps himself, and was designed to take the place of the wrought-iron wheels imported for the John Stevens (shown in February issue), which broke the spokes after a few trips. The wheel shown has a webbed disk out as far as the crank-pin making a very strong section and leaving the spokes all of the same length and weight and bearing the same load and strain. These wheels were used as long as the locomotives ran, and never so much as cracked a spoke; the spokes were of the I section, afterward much used by the Norris Locomotive Works. They were hard wheels to clean, but were strong and light. The Stevens' wheels were filled in between the spokes with thin wooden boards, to facilitate cleaning. Mr Dripps was the first man to run the John Bull on the Camden & Amboy road, yet occupied the position of master mechanic then. The first trip on the road with an open chimney set the country afire, and the experiments then entered into, that led to the adoption of the cone and netting, are interesting.

Mr. Dripps was master mechanic for the Stevens' brothers, and of their road and steamboat service, was Superintendent of the Trenton Locomotive Works for five years in the forties, and was one of the first master mechanics of the Pennsylvania road,



the first Supt. of Machinery of the P., Fort Wayne & Chicago, and for many years Supt. of M. P. for the Pennsylvania at Altoona He commenced with the earliest forms of imported English engines, and saw, assisted at, or himself developed many of the improvements made from 1831 to 1875.

A history of his long and eventful life would be as interesting as a novel, but it could not be written without writing a history of American railroads and American development of the locomotive.

Mr. Dripps lives in Philadelphia, happy in the possession of all his faculties, and is an open mine of information and experience to young men interested in railroading.

An Electric Signal.

F. H. Young and Frank I. Davis, of Port Morris, N. J., have invented an electric blocking signal. The plan provides for poles along the line of road, with a a clock dial upon them; this dial has the usual figures, and but one hand—the minute. The clock is provided with works that run continuously, but the spindle carrying the hand does not turn, except when held against a plate by a horseshoe magnet.

A tripping device beside the rails moves this plate back against the magnet every time a train passes. When a train passes the target, the hand releases from 12, where it usually stands, and is revolved by the works until it marks 45 minutes on the dial, or is released by another train.

An engineer passing the target can see how long it has been since a preceding train has passed.

The inventors claim that, by using a line of wire and batteries, the device can be rigged to tell how long since a train has passed a signal post *ahead* of the one displaying the signal.

All that is wanted is a device that will tell that the preceding train has passed the block ahead; any device that will do this automatically will be a successful device, but an arrangement that calls for winding a clock at every block, every day or every week, subject to all the ills of cheap clock gears, that depends for action on magnets or batteries, and that is operated by triggers along the rails, has many objections, and many chances to fail in bad weather.

Several of our subscribers have evinced some interest in this invention, and have asked our advice as to its usefulness.

We think it ingenious, and no doubt able to work nicely under favorable circumstances, but think it depends upon too many contingencies for permanent success.

The Inventor of the T-Rail.

American railroad men are so thoroughly familiar with the common T rail that the shape excites no interest at all. Yet it may be of interest to them to learn something of the difficulty its designer experienced in trying to introduce it.

In 1830 Robert L. Stevens went to England to study the railroad problem, and while there ordered the locomotive John Bull—the first locomotive to run on the old Camden & Amboy Railway On the trip over, Mr. Stevens began to study on the most desirable form of rail, and busied himself in whittling out model rail sections, finally hitting upon what has since become the standard rail of the continent. There were at that time no works in America that could roll rails, and Mr. Stevens ordered a lot of rails made to his model.

He was informed that such a section could not be made, and the work was refused, but he persisted, and finally leased a mill, giving heavy bonds to return it in as good condition as when received, and manufactured the rails himself.

Correspondence

Special Brand of Sand.

Editor The Locomotive Engineer.

In May number you illustrate a device for preventing sand pipes from clogging, it shows a fine stream of sand running just to a queen's taste I have had one of those things on my mill, and want to say that the photo was taken for that cut when using pet sand dried at Altoona; not common wet stuff. The bell is almost as good as a common pipe, and don't appear to stop up any worse.

Philadelphia. KEYSTONE.

Pull of Reverse Lever and Setting Eccentrics.

Editor The Locomotive Engineer :

In the December issue, "Primer," of Germantown, Pa., claims that the pull on the reverse lever is caused by the friction of the eccentric in the straps, and that the angle of the links has nothing to do with it. Now, Primer, why does the reverse lever pull very hard when the angle of the links is in the same direction, and not pull so hard when the links are at opposite angles? It is just exactly as you state, that "the angle of the link tends to lift the block in one-half of its travel, and pull the other." When both links are pulling, the reverse lever pulls hard; when one link is forced up and the other down, the reverse lever can be moved towards the center of the quadrant with ease. Primer, which makes the reverse lever pull the hardest, a warm eccentric, or a valve that is dry? I agree with you that it is "better not to know so much, than to know so much that is not so." I have waited for the draftsmen to answer this as you requested, but they don't tackle it.

Then, in May number, C. W. K tells us "to set the engine on the forward center, put the throw of the back-up eccentric down, move it toward the pin enough to give it the amount of lead, and fasten." How far down do you move the eccentric, exactly perpendicular? If so, do you not allow for the lap of the valve also in moving it towards the pin?

Some of us young runners would like to know about these easy and *sure* ways.

Lansing, Mich. C. B. CONGER.

A Good Suggestion on Indicator Rigs.

Editor The Locomotive Engineer.

In Manning's rig for indicators I note the convenience and improvement in putting a wooden extension on the tumbling shaft arm, and noting point of cut-off at the chest instead of the cab. I would suggest that this rig would be further improved by making the rod long enough to reach *by the chest* far enough to allow its being seen by the man on the left side, and making another set of marks on the left side of it for his benefit.

Meridian, Miss. JOS. E. HOWELL.

Criticisms on Honesty.

Editor The Locomotive Engineer:

One prominent feature marks your publication that I have noticed—the absence of controversy. This is, indeed, commendable. Let each reader take his exceptions to himself, and there let them rest. I have no desire to intrude on what should be an iron-clad rule established by the editor; but the last issue of your paper calls up expressions of silent thought and opinion. John Alexander's statement is quite personal, uncalled-for and out of place (in your paper). It should be classed with his wet-nurse story in April issue. Doubt dawns on me that John will not name his last baby "Pete," if it is of that sex. I hesitatingly attempt to use your columns for personal criticism. John made a statement; I hope I can do the same, and fairly say, without fear of truthful contradiction, that he errs. It is true that men may be at fault "talking about each other" during meetings held in their division rooms. This is ofttimes excusable, for they frequently do not meet "to pass the time of day" at other times, but your paper is no place to discuss what is done at B. of L. E. meetings. We expect mechanical notes in a monthly that is devoted to mechanics. I know there are readers of THE LOCOMOTIVE ENGINEER that will agree with me in saying we want more facts about locomotives, and less regarding grievance committees. I want to learn more of the Webb Compound. Your squib in last issue is not satisfactory. If "Jack the Ripper" was pulling the "Paoli accommodation" you should have given us a full report, and not a mere guess; a telegram to and reply from Philadelphia the day you went to press would have advised you if she made the time or not. The absence of side-rods on the Webb is probably one point in her favor. The Strong engine "gets a shot" also quite frequently. As yet I cannot determine what she is doing towards proving the correctness of design. Men in the West know the Strong Duplex No. 444 made the time, and pulled a full train with one-half the steam pressure the "Standards" did. She was no "cabbage cutter," if the Shaw and the Webb are. Mr. E. V. Debs may well feel proud of the several liberal mentions of his name in your last issue. The editor of THE LOCOMOTIVE ENGINEER seems now to concur with Debs in everything, much more so than at the time of the removal of Mr. Smith, M. M., P. D. & E., about one year ago. You rather held up to scorn the Grand Intercolonial International B. of L. E. grievance committee on account of the action they seemingly took. Mr. Debs expressed his ideas in his magazine in a very forcible, logical manner, upholding the men and denouncing Smith, quite unlike your scathing comments—considering the Debs article—as possibly could be. Several favored Debs, many advocated his ideas and endorsed his statement. We expected he would call you to time, he never did, but ought to all the same. We want more "kinks" from practical men. Agitation is an evil, and such matters should be confined to the monthly meetings of engineers and firemen. Your continual allusions to the grievance committee excites some suspicion. I hope you never wrestled with one. Some men think and act as if they thought life was a big joke. Others seem to live for the sole purpose of trying to be as mean as they can, instead of attending to their own business and doing much good thereby. Others want to put the bit in one's mouth, if they fail and can't drive, they explode. If they criticise they do it in a way to attract attention solely, while others would take a different and much more effective course. If your production would give us more facts and ideas, or detail more closely the tests of late designed locomotives, would it not be better and look as if you were not prejudiced? We must be progressive from this time on, for railroad companies are looking to their p's and q's, and the many leaks and small losses. Coal and water, in readiness to be put on an engine, have different values; economical use of fuel will take the lead. Men must educate themselves for the coming of improved locomotives—judging from progress in other lines of mechanical appliances. They have been, in many cases, like the master mechanic on the Erie in 1849—Brant by name—who told Thos. Rogers, when he delivered to the Erie the first link motion engine, "that the links were not worth a damn." In reference to Q. finances you are late with your report, your late trip to Indiana ought to have been made sooner. The writer is convinced, beyond the shadow of a doubt, that the funds were distributed in a business-like way—economically and prudent. You report engineers expressing different opinions. Well, men do frequently trump up a lame excuse for not subscribing for every publication in the market. Some may have offended the representative of your paper, and offered this excuse for not putting up one dollar, and adding their name to your list. He who does so makes a grand mistake, for ideas contained in one issue are ofttimes worth *one* dollar. Mr. Smith, of Delaware, Ohio, wrote several worthy articles for you one year ago, which appeared in your paper. They were good, and I miss his valuable contributions. If the N. P. adopted his heater, will Bro. Phelan advise us of the net results?

The *Scribner's Magazine's* railroad articles did not put enough stress in any way upon the fact that railroad men are frequently overworked. How would it do for you to look this matter up, as you did the grinding and fitting of steam pipe joints? Why not solicit reports from our many friends of the footboard, asking them to state the hours of natural rest they are deprived of each week (inter-state commission N. B.) and the consequent bad results? While this is being done, tell us what you know about the remedy for a hard riding engine, where to look for the many causes, solicit reports from men qualified to suggest effective changes that will remedy the *hard riding obstacle*. Kidney cures are now a profitable invention, and the retail sales are on the increase every year. Can't you help to offset the growing evil? Acknowledgment of the truth is very wholesome. Let us contemplate and reason together; build up and not pull down.

Watertown, Wis. CHAS. E. STRAW.

[This correspondent commends an iron-clad rule, and then asks privilege to break it, and were it not for the fact that we are not only opposed to iron-clad rules, but want all sides to be heard, and *do* favor controversy to a certain extent, we should not publish his article—as it simply challenges our right to criticise B. L. E., B. L. F., or Grievance Committee actions, to honestly say what we believe and to report what we hear.

As we gave our correspondent John Alexander room to say something of the trouble in the orders, and he gave a rather comical view of the case, we let this article appear in answer.

Let us say right here that this paper is run in the interests of the engineers, firemen and railroad mechanics of this country, not in the interests of one class or order, that its editor is a Brotherhood engineer, and a firm believer that all the railroad orders have done good in the past and are capable of doing much more good in the future, but that this paper reserves the right to approve of all the good, and condemn all the bad it can see, both in and out of the orders. There are no strings to us. The curt reference to grievance committees falls short of the mark—our "wrestle" with them has been limited to a job of serving on one. They have gotten the orders into lots of trouble, caused endless dissatisfaction and discontent, and are, in our humble estimation, the curse of organized labor—and we are not afraid to say so.

If a monthly tried to keep telegraphic reports of an experimental locomotive like the Webb, dodging from run to run every three days, forty pages would not contain the report. She has been fully illustrated and described in this paper, and each month since, items given of her service—item in another column is not a guess, simple record of what she is doing. The "Strong" engine was fully described in all the mechanical papers, before this journal was established, and we did not deem it necessary to show up an old thing because another of the class had been built. We have said that we did not believe it was the future engine of the country, because they cost about twice what a Standard locomotive does; they are complicated, heavy, clumsy and very difficult to repair. The "Duplex," that our western engineers know so much about (?), has never equaled a Standard locomotive service of the same weight and carrying the same pressure. (The "Duplex" carried 180, the Standard 140.) The new Strong, the Darwin, has not steamed well, has her nozzles bushed to 3¼, and we simply ridiculed some of the ridiculous claims made for her, and will do so again—when other papers invent another story to praise her other than the "80 miles per hour and holding her back" idea.

The praise we gave to E. V. Debs was no fulsome eulogy, but in each instance was called out by some act of his in the interest of laboring men, or mankind in general. We propose to commend modest worth and ridicule the big head wherever and whenever we stumble onto it. Mr. Debs and the editor of this paper differ on many subjects, but not necessarily on all. He said Smith was to blame in the trouble on the P. D. & E. on general principles. We investigated both sides of the story and found out that there was dirty work on both sides of the fence—and said so. Our subscriber admires the *other* Smith, of Delaware, O. (because he was not assailed by the engineers there), he may be interested to know, however, that they are one and the same Smith.

Our criticisms on the finances of the strike were made in the interests of the engineers' order and with a view to having the laws changed so as to remove suspicion from committee men. In this connection we may say to the cross-examiner of our methods that there never has been a representative of this paper soliciting subscriptions anywhere, except self-appointed men on their home road. When a stranger solicits subscriptions for THE LOCOMOTIVE ENGINEER, put him down as a fraud. The editor of this paper has never asked a man on earth to take it—and never will. We propose to make it so valuable to the class it is published for, that they will *order* it.

The animus of the correspondent is plain; he is not consistent; he wants everything detailed except such as tell any unpleasant truth about the affairs in our order—cover everything up there, ask no questions, make no comments, suggest no changes in the existing order of things—be a clam. Then he goes on to say what we must do, how progressive we must be, studying economy, watching the leaks, etc., etc. If our correspondent will look back over our files, he will see that this is just what we have been teaching. We have advised discussion of things—not men—in the lodge rooms, we have preached progress, study, discussion and self-help—and we are not half through. To answer all men who may think as our correspondent does, we will say that this paper will run along on the line of independence on which it has started, that it will condemn the wrong, and extol the right of everything that is of interest to the men, be it in the lodge room or the general office.

We are not responsible for the private opinions of correspondents, but for every line in this paper the editor has to answer—and will do so, but when we feel it necessary to refrain from criticising the wrong acts of any one man, or set of men, or to extol the doubtful merits of inventions for advertising purposes, we will surrender our pen to some sycophant afraid to say what he thinks and take the consequences.

Every reader of this paper can depend that what is said in it, for or against everything or anything in our line, will be our honest opinions—they cannot be bought, bulldozed or influenced, but we will change them when they are proven wrong.]

Ohio-Built Locomotives.

Editor The Locomotive Engineer:

The locomotives mentioned by your correspondent as "built somewhere in Ohio," were no doubt the old "Cuyahogas," built at Cleveland; many western roads were stocked with them. The Lawrence engine was built at Lawrence, Mass.

Galion, O. OLD TIMER.

About the Swinerton.

Editor The Locomotive Engineer:

In your number for June appears an article signed "Fireman," criticising what I said about the Swinerton locomotive driving wheel in a back number of the *Firemen's Magazine* and to which he takes exceptions I simply wrote about what I saw or had been told by persons whom I have no reason to think were interested one way or another in the device. The action of the engine—or rather of the wheel—and her "pulling" qualities I feel myself competent to pass judgment upon. I have had some experience with undue weight on driving wheels on locomotives. The single-wheeled engine No. 507, built by the Baldwin Locomotive Works, was a case in point. Later on, the engines built by same company, and designed by Geo. W Cushing, Supt. Motive Power for P & R. R. R. Co, was another Their driving boxes *could not be made to run cold.* When I first saw the "Onward," I looked for just such a state of affairs as "Fireman" claims to exist, viz.: excessive weight on driving axles, and, to satisfy myself on the point, felt all the journals of the engine during and at the end of the trips, and found no appreciable difference in the temperature—they were all cold. My authority for statement of weight on the "Onward's" driving axles is the general foreman of shops at Portland. I would much rather believe "Fireman" to be misinformed than that my informant told an untruth. I have met many shrewd Yankees; don't remember ever having ran afoul of a foolish one. It would be supreme folly in the Swinerton Driving Wheel Company to misrepresent the weight on the driving wheels of the "Onward," when 10 minutes on the scales of any R. R. would expose the deception.

"Fireman" says the original weight on the drivers of the "Onward" was 41,000 lbs., and that, as a result, the boxes ran hot; he understands some of this weight has been taken off Does he know how much weight was taken off? and if he does not, how does he know that my statement of the weight on her drivers is not correct?

I will not find fault with "Fireman" because he cannot see the facets on the Swinerton wheel. I have met many men whose physical and mental vision were obtruse, but I have yet to meet the railroad engineer or fireman who ever knew a *flat spot to wear out of a locomotive wheel, driver, truck or tender!* See?

Truth sooner or later asserts itself. If the "faceted" wheel is all that its inventor claims for it, the fact will be manifested; if it is not, experiment will demonstrate that also. I would not have noticed the attack of Fireman on the *device*, had he not made a *personal* reference to myself.

E. J. RAUCH,
Road Foreman of Engines, M E. R W., E. D
New York.

To Set a Slipped Eccentric.

Editor The Locomotive Engineer:

Place the engine on forward or back center, as preferred, on side slipped eccentric is on (it is usually more convenient on forward center, as this brings the set screws forward of axle, and I shall use forward center); if it be the back motion which has slipped, place the reverse lever in the corner, forward motion, loosen slipped eccentric, roll swell to under side and slightly forward of axle, enough to roll off lap and lead; now see that the steam chest gland is tight enough so that valve stem will not move it in passing in and out; make a fine mark on valve stem, even with face of gland, with any sharp instrument, as the point of pocket knife, or anything at hand; now place reverse lever in corner, back motion and roll eccentric forward and upward until the mark on valve stem comes to the same point as before; tighten set screws in eccentric slightly; now place reverse lever in forward corner; if the mark on stem comes to the same point as before, the eccentric is right; if it does not, it will be quite close; if not as close as you would like it, make a new mark, place the lever in back corner and alter eccentric to suit new mark, tighten set screws and the work is complete. To set forward motion, place reverse lever in back motion, roll swell of eccentric above and slightly forward of axle, and proceed as in back motion. I give it in this simple manner, that any engineer with the assistance of his fireman can set a slipped eccentric quite accurately and quick under any circumstances, if he has even as simple a tool as a *pocket knife.* A small, machinist's scriber is a very nice little tool to do this work with, by placing the straight end in the center of one of the gland studs, and marking the stem with the hooked end. L. H. KENYON.

Allegheny City, Pa.

Old Fogy's Canvass.

Editor The Locomotive Engineer.

In the June issue of the *Master Mechanic* one can take pleasure in reading the comments on throttling locomotives, and it is of the same old story of proving it to be facts, by figures, regardless of what the actual results will show when put to a test. Theory nor figures ever pulled enough cars over any road to pay a one per cent. dividend as yet. What the writer is anxious to know is, if the "high science" can be proven by actual labor performed, am of the opinion that it cannot be done. I have made close inquiry on roads where a premium is offered for saving of coal, and the premiums are awarded every month. A performance sheet is published, showing who saves coal and who uses more than the allowance. By following these up month after month, and getting the run of those receiving the premiums nearly every month, and those that run behind on allowance many tons of coal, it gives one a chance to get the dimensions of his man, and how he runs an engine

When you have your men arranged in two rows—one coal savers and the other coal wasters—in the row of coal savers you will not find one "full throttle fiend" out of five "old fogies"; but look in the row of coal wasters, you will find them well huddled together explaining why they did not get any premium, each one having some good excuse—in his mind—why he got left Something like this: "Valves are out—ought to be faced"; "packing all gone—not fit to run", "engine rides so hard—shakes coal all out of fire-box," etc, etc. At the same time the old fogy walks away with his 10, 15 or 20 dollars for not knowing how to run an engine correctly according to rules laid down in our text-books, which are—many of them—written by men that never did a day's work at the throttle, of which they can teach you so much—infallible, and must be correct because it is the true theory of locomotive practice. Now to discuss a question of this kind, and to allow your opponent to make his assertions, and then prove them by his own assertions made at some previous debate, it leaves it a one-sided case. One solid fact will outweigh a whole bookful of "ought to be so's." OLD FOGY.

Germantown, Pa.

[This correspondent refers to the men who regularly earn premiums on the Pennsylvania road. He has made a very complete canvass of the men as to the wide-open throttle plan, with the above results.]

A Man who Remembers the Old Timers.

Editor The Locomotive Engineer:

I see in June number what is written about center of gravity that the C., M. & St P. have a Schenectady, whose center of boiler is 8 ft. 9 in. from rail. What is the object of this? Is it to use large drivers? We have some engines that measure 7 ft. 5 in—we think that is high enough. Is there no danger of such high boilers tipping over when wheels go off the rail, or off end of ties? Are not such high boiler locomotives harder on their springs?

When I first began this business, and I can say for many years since, the study was to keep boilers down as low as possible. "Top-heavy" don't cut any figure now a-days. There is no fear of the result of top heft now. Does this theory hold good over other things, say, on a ship? Do tall masts or spars have any effect on her rolling and tumbling around? Perhaps not. This is on the water, a locomotive is on land, or a rail. *

I note that C. S. C., Milwaukee, asks concerning the old Lawrence locomotives, built somewhere in Ohio. I have long been acquainted with Lawrence engines, but never knew they came from Ohio, was always under the impression they came from Massachusetts. As to the cut-off valve on top of main valve, I never knew of any Lawrence engines with such a valve—but have seen them with a variable cut-off valve working on a separate seat *above* the main valve, and if C. S. C. will go to C., M. & St. P. shop and inquire for Lawrence engines 11 and 12—that used to be their numbers—he will find two engines that used to be of the build I mention; but they were rebuilt to link motions about 1861. They were V hook and variable cut-off, and could run faster with that motion, with less steam, than ever since with the link—and I may say the same of any other engines rebuilt from hook and cut-off to link—who can say different?

One correspondent asks about chilled valves; you don't seem to answer his question just right. Chilled valves and seats were introduced long ago by M. M. Stevens, of the Central Pacific R R, and run for a long time with good success. I have talked with engineers who have run engines with these chilled valves. H. KINGSLAND.

Ft. Scott, Kan.

More Short Cut-off.

Editor The Locomotive Engineer:

Mr. Alexander, after giving us an amusing account of the pleasures (?) of paternity at a late period in life, gives us some of his ideas on the short cut-off and wide-open throttle theory. Mr. W De Sanno has also thought it proper to add his voice to that of Mr. Alexander.

I have a sort of a roving commission to fight for the propagation of right and truth, in any and all fields. I trust that you will grant me space enough to review some of the arguments, statements, and objections raised by your correspondents, to the theory of which I am an ardent advocate, and which I feel assured you would have fairly represented and explained. I am not a believer in running "in the center notch," but do advocate running with the lever as near the center notch as is possible, and in the determination of the proper point to work his locomotive, the engineer has to be guided by the grades, the size of his train, and the condition of the valve gear of his machine. As a rule, no road in the country will send a locomotive over the line without a load, and in nearly all cases this load is just about all that they can get over the grades with. I have found locomotives which were so faulty in their valve gear that they could not be run according to the theory, but when locomotives are sent out to work in that condition, the engineer cannot be held accountable for any waste in fuel or material. In order to get at the best practice of the economical use of steam, let us consider the difference between an old-fashioned stationary engine and the famous Corliss type of engines, which is universally admitted to be one of the most economical of all the various kinds which are competing for public favor. There is no difference in the way in which the steam does its work in the cylinders of the old or the new engines, for in both engines steam is admitted on alternate sides of the piston, to drive it back and forth. In both types of engines we have a governor which regulates the speed, but there the similarity stops; for, while one governs in one way, the other uses an entirely different way. The old-time governor, being adjusted to a certain speed with a given load, keeps the valve open to permit steam to flow to the slide valve, and by it to be admitted to the cylinder Whenever the load becomes less, the speed increases and the governor partly closes the steam valve, thus checking a part of the power there, and wire-drawing the steam, as it is called, and while the slide valve moves just the same as it did before, admitting steam just as far, and cutting off and exhausting at the same points, yet it is evident that we have not near as much power. The governor of the Corliss type is so arranged and connected with the valves which admit steam to the cylinder, as to vary the cut-off just in proportion to the work that is to be done, leaving the throttle unchanged and thus delivering steam, at all times unchecked in speed and power, to the valves, and leaving it to their action entirely to determine the amount of work to be done. This ought to make it apparent that a cut-off in proportion to the work, instead of throttling to the work, is the proper method; and it is the application of this principle which has made the reputation for the Corliss type of engine, and will also give the engineer who follows out the rule, according to the dictates of common sense and good judgment an equally good name.

Now let us see how this principle works when applied to actual practice. On our road we have trains which we cannot pull on less than 7 inches, and sometimes not on that, unless under favorable circumstances. Will Mr. Alexander and W De Sanno please make a note of this as the shortest point of cut-off that we can hope to have in actual practice with full trains on this road! Now, years ago I frequently ran a Cook locomotive at the rate of 15 miles per hour, over a portion of the road, and found that I could make time on 7 inches, and that the pump would keep the boiler supplied. If I was obliged to use the next lower notch (9 inches) to make the same speed, I found that the pump would not supply the boiler, even if I closed the throttle in part. The pump running at the same speed over a given piece of track would certainly force as much water at one time as at another, it is therefore self-evident that by using 9 inches, instead of 7, we are using up water faster, and, if so, that more heat has to be expended, and thus more fuel consumed to produce this heat. Some engineers, however, seem to imagine that, by throttling the steam, they do not admit as much as they would by a full throttle, this would imply a piston moving partly by steam pressure, and partly in vacuum. Natural laws, which tend to destroy a vacuum, forbid the assumption that the partial closing of a throttle only permits a partial filling of the cylinder with steam, for the boiler, being in direct communication with these parts, would send out its steam not only by its expansive force, but even as a supply to fill a vacuum, in the same manner as air will fill all spaces accessible to it. As air cannot enter to fill any portion of this imagined vacuum, steam stands ready and is the substance which does fill this space, and being filled it ceases to be vacuum. Believing, as I do, and so many practical engineers concur, that steam follows the piston to the point of cut-off, no matter in what shape you may place the throttle, I deprecate the idea of running on 15, 13, 11, or even 9 inches whenever 7 inches will make speed and time and make a square exhaust. (While the square exhaust does not help make time, it is as unpleasant to a trained ear as a lame horse is to sight of a merciful man.) Mr. De Sanno views the matter from a machinist's point, saying that he had faced valve seats, which had been cut down one-eighth of an inch in the center, with planer marks still visible at the end of full travel; all of this being done in one trip of 214 miles. Now this was certainly an exceptional case, and I take it as such, for, from the very words which De Sanno uses in his description, I am led to believe that it was the only one as bad as that, which he could find. I am willing to admit that valve seats wear out faster in the center than at the edges by a short cut-off, but attribute this to the fact that, with the short cut-off, the valve does not come in contact with so much of the seat, and as its load is thus carried by a less surface, its attrition is greater. The objection raised by De Sanno, that the pressure on the valve becomes too great by admitting steam with full pressure, and that he actually ran faster by relieving a valve of this pressure, is not borne out in practice, or why should the most approved methods be for an increased boiler pressure, and what would be the use of increasing this if it were good policy to kill it again before permitting it to do any work? Again I would ask which takes the most power to move, a valve under a given pressure 7 inches or 10 inches for each revolution, or in that proportion? The probable answer will be in favor of the short stroke, even if loaded somewhat heavier. The question thus resolves itself into something like this. As valves and valve seats will wear out and require facing under any circumstances, will it be good economy if I wear the faces out once in six months oftener, if I can by this means do my work easier, save labor for my fireman, and put over a thousand dollars into the treasury of the company, through a smaller bill for fuel? Or which is the most $1,000, or $10? These figures are not fancy sketches, but have been verified by actual experiences, and comparison of the fuel bills of locomotives of the same class, doing the same work, and yet showing a balance in favor of the short cut-off and wide-open throttle locomotive of over $2,000 per year. Is this not an item worthy of attention, on a road using a hundred or two of locomotives, and which would form a surplus of a million of dollars on a road employing 500 locomotives? Some roads, however, seem to pay no attention to the fuel question at all, permitting their men to take as much or as little as they please, and not even making any attempt to ascertain the amount consumed by each locomotive, but charging all to a grand total coal bill, and that, with such management, it is not a very small one, follows as a matter of course. By late paragraphs in the press, I see that the Penn. R. Road has adopted a plan of paying each engineer and fireman a certain sum, for all coal saved by the men from a stated adequate allowance, and this will no doubt put all on their mettle, for each one is sure to be rewarded for everything saved, even if he should not be the most economical, and gain a prize, as is sometimes given by other roads to those who have made the best show for a year. VULCAN.

[Our correspondent makes unfair comparisons: there is no similarity whatever between a Corliss engine's valve gear and the link motion. The Corliss gives a full port opening at any point of cut-off—the valve unhooks and drops to its seat. While the exhaust valves, being independent, and not under the control of the governor, allow the steam to follow the piston almost to the end of the stroke. When a locomotive is cutting off very short, the exhaust occurs proportionately early, before the steam has time to do much work when the pin is in position to best convert it into motion. In an ordinary 8-wheeled locomotive, 17x24 cylinder, valve travel 5 inches, lap ¾ on each side, and steam port 1½ inches, cutting off at 6 inches, the exhaust occurs at about 12 inches of the travel. Of course this would depend on radius of link and amount of lead. With no lead at all, exhaust occurs at about 17 inches, and with a lead of ⅛ at 6 inch cut-off, which is about or below the average, it occurs at 12 to 13 inches, and, the valve being line and line inside, compression begins at half stroke, or the point where exhaust occurs.

In cutting off very short the exhaust opens too early, and compression commences too soon. On locomotives having very short eccentric blades, where the lead increases excessively when hooked up, the compression often exceeds the steam chest pressure, and lifts the valve, allowing steam to blow through into the exhaust, making the engines pound badly and ride hard.

With our correspondent John Alexander, we do not believe in full stroking engines, nor yet in working them so close to the center as to make them disagreeable to ride and hard to steam. He says he believes in working the lever where the engine will pull her train easily, clear herself, and not show symptoms of excessive compression, and in working the throttle in any position that will do the work and make the time—and we agree with him.

Correspondent De Sanno was perhaps a little over zealous in saying "the center," when he manifestly meant very close to it, and we do not believe in full stroking to save valve seats, but he has, no doubt, had a great many years of experience, and, like the majority of other men on the road, knows that trains cannot be successfully or economically handled with a full throttle all the time, and speed governed by the lever.

In discussing this subject it would be well for all to remember that wire-drawn steam, as it is called, does not represent the loss indicated by the difference between boiler and chest pressure. In wire-drawing it we have created friction, and friction makes heat. In some recent experiments made in this city by Prof. Denton, of Stevens Institute of Technology, by using a high pressure of steam, and wire-drawing it excessively, it was superheated enough to entirely do away with cylinder condensation.

So good an authority as Prof Rankine called attention to this point several years ago, as a matter of great importance.

With an engine having an early cut off, early exhaust, and therefore excessive compression, it is always necessary to have more clearance in the cylinder. All single-valve automatic engines have more clearance than plain slide valve or throttling engines of good design, and we all know that clearance is a necessary evil, and we want as little of it as possible

Just what our correspondent means when talking about vacuum in cylinders, caused by partially closed throttle, is not clear. He seems to be the first to think of such an idea

We want all sides to be heard in this discussion, however, and invite all those interested to have their little say.]

Pump for Machine Tools.

While at the Schenectady Locomotive Works recently, we noticed that on every machine tool cutting wrought-iron, a pump was used to return the water, oil or suds that ran off the work back to the tank. A very simple pump—which we show in the engravings—is used. The frame is cast in two pieces bolted together, as shown; the shaft, carrying a small pulley, runs in solid boxes, and has on its outer end a head with a slot through it, as shown in Fig. 2. There is a cap screwed on the frame, and enclosing this head. The head turns in the cap, but just clears the top, while it is ¼ an inch or so from the bottom. The head on shaft fills the cap endwise, and two flat bars of iron fitted into the slot in head, and held apart at the center by a small coil spring, make a practically tight packing. The supply or suction pipe enters at one side near the top, and the delivery is tapped from the other side near the top. As the shaft is revolved toward delivery pipe, and from the supply, the wings of the head force the water ahead of them, and the proximity of the head to the top of case prevents its running around to the other side, so it goes up the pipe

These little pumps are easily made, do not wear fast or become clogged, as is the case with valved or plunger pumps, and will pump any kind of fluid, no matter how dirty, if it will go through the pipe They can be belted to most any shaft and run at any reasonable speed

In the ones we saw in use, the head was about 2' in diameter, running in a 2¼ case.

Pedrick & Ayer, Phila., have adopted this pump, and all their milling machines will hereafter be fitted with them.

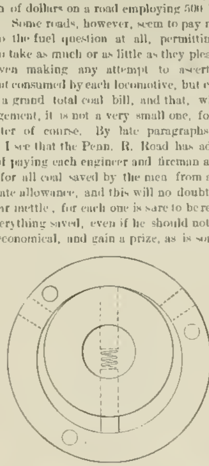
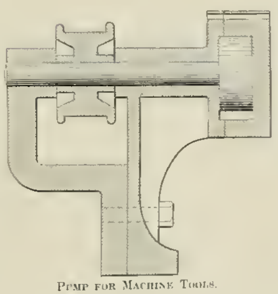


FIG. 2.



PUMP FOR MACHINE TOOLS.

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☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS

The Souvenir Advertising and Ball Ticket Nuisance.

We wish to warn the different orders of railroad men of the false and humiliating position they are getting their organizations into, by attempts to raise money, for fraternal and benevolent purposes, by drumming advertisements from manufacturers of engineering supplies for convention and picnic programmes, and in sending out "blocks of five" ball tickets to distant cities, expecting manufacturers to buy them—to keep their wares in favor with the men. No other inducement is urged; the manufacturers cannot attend the ball. No one not on the inside, can imagine to what magnitude this nuisance has grown in the larger cities.

Locomotive engineers, firemen, stationary engineers and many other noble orders have let this disease grow upon them unawares.

We know of one very large firm, who annually set aside a large sum of money for this purpose, mark the amount "loss" on their ledger, and enter it upon their cash books as "blackmail money." This is not very complimentary to those who receive it.

Locally, the selling of tickets, or even advertisements in a programme are all right; the ball or other entertainment is a good thing for the business men of the town, they cater to the cash trade of the railroad men, and it is but fair that they should help the boys out once or twice a year. We notice that even the churches fish for the boys. When they have a fair they always have up a clock, a cane, a watch, or a slipper-case for the most popular engineer or conductor—and let the boys pay about four prices for them.

The idea of asking big prices for a little local advertising, from manufacturers at a distance, deserves the epithet of blackmail. We recently saw a letter from a local lodge of mechanics in an interior town of an interior State, who sent with it five ball tickets with a bill of $5. The letter went on to say that they were getting up a fund for a library, and that they proposed to favor the goods of those men who patronized them. If the manufacturer would accept the tickets—and pay for them—they would be pleased to give his goods the best show, and try to have them used where they were employed. This is a shameful confession of incompetency as mechanics, and disloyalty to employers. By the payment of a few dollars they would agree to decide on the use of tools and appliances regardless of their merit as the best tools for the purpose—this is the "something in it" idea—it is pretty close up to the blackmail idea.

These very men would resent as an insult the charge that they were begging—yet they would stand higher in the estimation of all, if they substituted begging for present methods. We recently ran across a man from one of the interior villages of New Hampshire, who was canvassing the city of Philadelphia for advertising for a programme of a sacred concert, given by an association of mechanics, that is what we would call unadulterated gall.

Friends and brothers would it not look better, more independent and more manly to abandon this idea?

Would it not be better to confine these ball and picnic collections to your own towns?

Would it not be better and look better, for our grand lodges to meet as a body of dignified business men, and transact business only—and not have a jamboree, sociable, side show attachment? Now each succeeding committee of entertainment try to eclipse the programme of the last one—have a bigger ball, a finer banquet, more carriages, and a more expensive excursion.

It seems to us as if it would be more independent for each lodge to pay the legitimate expenses of its delegate and then let him entertain himself.

Confine the duty of the committee to the work of securing hotel accommodations for the delegation, and securing and decorating a hall, but prohibit them from investing money in a banquet or other entertainment. Let the citizens do what they care to, but do not say to manufacturer Jones, in a far-off city, "Put up, or we will condemn your injector, drill press, packing or axle grease, and recommend that of manufacturer Smith."

You have an influence in the purchase and the success of all devices placed in your hands—no one can deny that—but let it be understood that your approval or disapproval will be given on merits of the different devices—not that you can be bribed to recommend an inferior device.

This matter has grown to be a disgrace, brothers, and to one and all we would say that a prompt setting down upon the idea in every form will add to the self-respect, independence and reputation of your orders and the members thereof. Think it over and—Don't.

"Pauper Labor."

We are under obligations to General W. S. Rosecrans, Register of the U. S. Treasury, for an advance copy of the report of the Congressional Committee sent to investigate the labor troubles in the anthracite coal regions of Pennsylvania.

This committee was sent out to investigate these troubles after the great strike of 1887—'88, and to find out why it was that the Philadelphia & Reading Railroad Company could not or did not comply with the provisions of the Interstate Commerce Act.

The committee took a vast amount of testimony, including that of the general officers of the Reading Road, and all classes of men in all employments in the district, including some of the sixty-cents-a-day miners.

The report of the committee is fearless and sweeping, showing the manner in which the mine owners, the railroad officers, the Pinkerton coal and iron police and the officials of the commonwealth, combine to defraud labor of its just reward, force the public to buy coal at a fictitious price, and gamble away the rights of the people.

Such an arraignment of a public officer as Gov. Beaver gets, we have never seen in print—they wring in the deadly parallel on him.

The way the coal miners live (in good times) is awful, and in hard times can only be imagined. The book abounds in tales of suffering, oppression, wretchedness and crime.

To those of our friends who are reading the *Century* articles on Siberia, and want to scalp the Czar and all his minions, we would like to say that there is no use to go so far away from home for a chance to revenge wrong.

The American people are afflicted with "far sightedness"; they can see the half naked and suffering Hottentot in the African jungle, and immediately send a missionary to his relief (?), but they cannot or do not see the equally naked and suffering white children in the hovels of New York.

They read with indignation of the sufferings and the cruelty in the mines of Siberia, but they cannot or do not see the slavery, the cruelty, the suffering and the crimes committed in the mines of Pennsylvania.

We talk pityingly about the condition of the people of Siberia, of Ireland and of India, and, smiting our breasts, brag of the free born American, who is a nobleman and jealous of his liberties, but after carefully reading a report on the condition of laboring men in his own country, and by a committee of the national Congress, our free born American nobleman ought to have a chill, and never again be heard harping about the "pauper labor" of the old world until he has moved heaven and earth to make a change in the condition of the "pauper labor" of Pennsylvania.

Jay Gould.

It has come to be every-day practice for all who wish to attack monopolies, corporate power, greed, injustice or despotism, to fairly froth at the mouth at the very mention of the name of Jay Gould.

The devil is not always as black as he is painted, and we wish here to remind the railroad boys that there are several things about Jay Gould's management that is to their best interests, and that brings him above the average railroad manipulator—so far as the employes are concerned.

While no doubt Mr Gould is a shrewd stock speculator, who does not hesitate to wreck a road, or a dozen roads, to gain his ends, he invariably treats his employes well—as good or better than the average.

There are few if any roads in the United States to-day where the men receive better pay or are treated with any more consideration than are the employes of the Missouri Pacific and the other roads entirely under the control of Jay Gould. We know from positive inside information that Mr. Gould always gives his vote in directors' meetings in favor of buying the best machinery and supplies—not because he likes to see it, likely, but because he is sharp enough a business man to see that, in the end, the best is the cheapest. Every time Jay Gould gets the cinch on some of the stock gamblers in Wall street, we hear a cry about the "great octopus, etc.," and the claim is made that he has robbed poor widows and orphans who owned stock in some road. So far as we are able to see, Mr. Gould is a little bit bolder and more aggressive than other men in his line of business, and when he rakes in a pot of a million or two, he collects it from other gamblers—not poor widows and orphans. Poor widows and orphans are not in the habit of owning stock in railroads.

As long as Mr. Gould treats his army of railroad employes as well as the best, and does nothing in the way of money-making that any of us would not do if we but had the chance, we can see no good reason to abuse him. Of course no man is capable of earning, by his own industry, a fortune like Mr Gould's, wealth is produced by labor applied to nature, and if one man works as much and as intelligently as another, he should receive as much for that work, and where we find a few thousand men like Mr. Gould, worth millions, and a few million of workingmen worth nothing, it is but natural to infer that the few are receiving part of the remuneration due the many. It is not those who come to the top, like Jay Gould, that we should blame—it is the system and the false conditions under which we live. Who would not do as Jay Gould does, if he could?

The Master Mechanics' Convention.

The American Railway Master Mechanics' Association is not a secret order, but a great educational debating club, where the men in charge of our railroad motive power meet to discuss devices and methods, compare work and results, and pick up ideas to enable them to do their work better or cheaper.

Their 22d annual meeting was held at Niagara Falls on June 18, 19 and 20, was attended by something like a hundred members, who discussed a number of important subjects.

It is the plan of the association to choose a number of live subjects, appoint a committee on each to prepare a paper to be read at the next regular meeting, when it will be discussed, each member knowing that the subject will be up, goes to the meeting prepared to tell his practice in that line, and compare it with that of his neighbors.

One hour is set aside each day for the discussion of topical subjects handed in by the members, so that discussion is not confined to cut-and-dried subjects.

The meeting just held was a particularly interesting one, papers on the following subjects being read and discussed:

Purification or Softening of Feed Water, Exhaust Pipes and Nozzles; Tires, Advantages of Thick or Thin, Driving and Engine Truck-boxes, Boiler Covering, or Lagging, Driving Brakes; Proportion of Flue and Grate Area, Foundation Ring for Boiler Leg—Advisability of Double Riveting, Water Space Surrounding Fire-box and Flues, Magnetic Influence on Watches of Engineers.

There were several topical questions brought up and discussed, the one occupying the most time and attention being on the cause of bursting of steam chests, introduced by Mr. Stewart, of the Fitchburg road, who had come to the conclusion that this accident invariably happened just after oiling the valves, and was caused by the formation of gas. Engineers who have blown off covers by pulling their engines over to avoid collisions, and long after oiling, will not take kindly to the gas theory. It was remarked by many old members that, when they had the old slide throttles, chests were not blown off, as the air pressure pumped by the pistons could not exceed that in the boiler, as the valve would lift. We doubt if a chest was ever taken off by reversing if the throttle was opened.

Many exhibitions of new and old devices were exhibited in a room set apart for that purpose—which is an improvement over the old plan of having the exhibition at the hotels. The *Northwestern Railroader* published a daily, reporting the meetings very accurately.

John Thompson and George Richards, two active members from the start of the association, were placed on the Honorary List, and quite a number of new members were admitted, the young men just coming to the front in motive power work, show their appreciation of the help to be derived by such associations, and are anxious to identify themselves with such an educational institution.

The election of officers places R. H Briggs, of Memphis, Tenn., in the chair as president; John Mackenzie, of Cleveland, Ohio, 1st vice-president; Albert Griggs, of Providence, R. I., 2d vice-president, O. Stewart, Charlestown, Mass., treasurer, and Angus Sinclair, New York, secretary. J. H. Setchel, the retiring president, has been in office, either as secretary or president, for nineteen years, and has been an efficient and able officer. The vote of thanks and the cheers he received were flattering testimonials of his worth by his associates.

Within the next six months the executive committee will decide on the next place of meeting, choosing between Chattanooga, Montreal and Buffalo.

The subjects for discussion at the 1890 meeting are particularly interesting and live subjects. They are as follows:

Compound locomotives—Their relative efficiency as compared with simple engines. Is the saving in fuel large enough to compensate for the extra cost of compounding and of maintenance of increased number of parts? Proper proportions. Are the conditions of the American system of railroading such as to render compounding advisable?

Testing laboratories—Chemical and mechanical. Are they desirable in connection with the mechanical departments of railroads? Does a marked saving in expense, by insuring best material through chemical analysis and physical test, result?

Link—As compared with other valve motions, Wilson's, Joy's, Walschaert's, etc. Has any device been found worthy to supersede the old-style link for economical service on locomotives, all points considered, first cost, cost of maintenance, length of service, convenience, etc?

Steel *versus* iron axles—As relates to friction, wear of journals and journal bearing, liability to breakage in service.

Brick arches in locomotive fire-boxes—Best manner of supporting them, their efficiency in consuming the various gases composing black smoke, saving of fuel when used in connection with extension front, and as compared with the diamond stack, first cost, and cost of maintenance. Aside from increased grate area, are there any other advantages to be gained by placing fire-boxes above the frames?

Locomotive tanks, or tenders—Best method of preventing corrosion in coal space—will it pay to shield the surface exposed to coal? If so, what is best material, and how should it be applied? The best proportion of steam passages in relation to size of cylinders and steam pressure.

The following subjects were added to the list:

The best form and size of axles for heavy tenders.

What is the relative value and length of small and large flues?

Secretary Sinclair received deserved praise for the prompt and efficient manner in which he had performed his work, and especially for the quick time in which he got out the report. His salary was fixed at $1,200—the only salary the association pays. The American Railway Master Mechanics' Association is a grand example for enginemen, holding open discussions on interesting subjects pertaining to their business, and the work done and plan followed by them could be followed on a smaller scale by railroad men everywhere.

Railroad men in every department of the service are daily meeting with new conditions and working to overcome new difficulties, each is having experience worth time and money to any one in the same business, and if many can come together at stated intervals, and, by discussion, each man get the benefits of the experiments of twenty other men, it stands to reason that the benefits are proportionately great.

ASKED & ANSWERED

(26) E. T. B., Toyah, Tex., asks:

What is the father of the "American," or 8-wheeled locomotive? *A.*—Henry R Campbell, of Philadelphia, in 1836, patented the form of locomotive with a double truck and four pairs of coupled wheels that has since developed into the standard engine of the country

(27) N. E. W., Brooklyn, asks:

How long will it take to release the vacuum brake on a train of five 30-foot cars, when there is a vacuum of 20 inches shown upon the gauge? *A.*—Air flows into a vacuum at the rate of 1,157 feet per second, or a little over 13 miles per hour. The brake would probably release in about 1/10 of a second; of course the beams and shoes would not drop back to place in so short a time, but they would be relieved of all strain from the diaphragms

(28) Henry S. Tierney, Waterbury, Ct.:

Would you please tell me what an engine that had four wheels connected and a pony truck would be called? They use them on the N. Y. & N. E. and they call them hogs. *A.*—We know of no particular name for the class of locomotives mentioned, except light passenger engines and 4 wheel connected with pony truck. The name "hog" was originally given to consolidation locomotives having a wagon-top boiler, but was soon used by the men for any large locomotive

(29) T. McC., Taunton, Mass., writes:

Please decide a dispute—a friend claims that Geo. Stephenson invented the counterbalance for locomotive driving wheels. I claim that the credit of this invention is due to Wm. Mason. Who is right? *A.*—Thos Rogers, founder of the locomotive works bearing his name, counterbalanced the weight of the engine connections of the first locomotive he ever built, and applied for a patent on the invention in 1837. The idea was ridiculed by other builders for some time.

The New Engineer's Brake and Equalizing Discharge Valve.

Since the last issue we have received several letters asking us how we expected men to come three or four hundred miles to see the air-brake sections, and asking for cuts and explanations for the benefit of those who could not see the sections. They will be found on page 10.

If the student will take the trouble to cut out the handle view, cut out the ports *j* and *o*, and shade the cavities *p* and *c*, which do not go through the valve, they will find it a great help in studying the problem. The disk on handle represents valve 13. We refer students to description of this valve in Air-brake Practice in April number.

The objects sought in using this valve instead of a 3-way cock are to have a reserve of 20 pounds more air in the engine drum than in the auxiliaries and train pipe, in order to insure the prompt release of the brakes, to provide for brakes being set in service stops without the sudden jerks and jars, and releasing of forward brakes caused by sudden closing of cock, and to provide a device in which the manipulation was always the same and that would in itself provide for the number of cars in the train and reduce the *pressure* in the train pipe, regardless of the *volume*.

All connections are marked on the cuts, in the upper left-hand cut 11 is simply a key attached to the handle, which turns valve 13 on its seat, in its present position it is in full release position, and the air from the main reservoir goes up the connection on left, over top of valve, down supply port *o*, around under valve to direct application port *l* to train pipe, charging the auxiliary drums and releasing the brakes

When the handle is moved to "position while running" (see lower left-hand cut) a bridge in the valve shuts off the larger supply port, and the air is obliged to go to the train pipe through the feed ports marked *f f*, and in so doing is obliged to lift the spring-seated valve 20 (see right cut) under plug 19, this retains 20 pounds more pressure in the engine drum than can be gotten into the auxiliary drums, and insures the release of brakes after any stop. When the valve is in this position, the equalizing port marked *g* is open, and the pressure forces down the piston 17, closes the valve on its stem, and fills a small drum attached at 24. This small drum is entirely independent of the train, and is used to measure the air pressure in reducing train pipe pressure to set brakes; this drum has a gauge attachment at W; there is also one at R, and the air gauge has two sets of works and two pointers.

When it is desired to set the brakes in service stop, the handle is moved to "on lap" position; this closes the equalizing port g, and entirely isolates the air over the piston and in the small reservoir, and a farther movement between the stops brings a port over the preliminary exhaust passage e, and allows air from the small drum to escape through a small port in side of case.

A reduction of pressure above the piston causes it to be lifted by the train pipe pressure under it, thus opening valve on its spindle and allowing air to exhaust to the atmosphere through pipe n, up, and air escape at n until the pressure in the entire length of train pipe is reduced slightly below that above the piston, so that a runner is not called upon to guess at the amount reduced, and exercise fine judgment in handling trains of different lengths—by reducing the pressure above the piston a given amount, the equalizing discharge valve takes care of the rest.

In case of accident, handle is pushed around to emergency stop; this cuts out all action of the piston, and puts the large exhaust port back of valve in direct communication with train pipe through the large passage marked Y.

We notice in riding on locomotives that there is a tendency on part of the engineers to leave valve in

Air-Brake Practice.

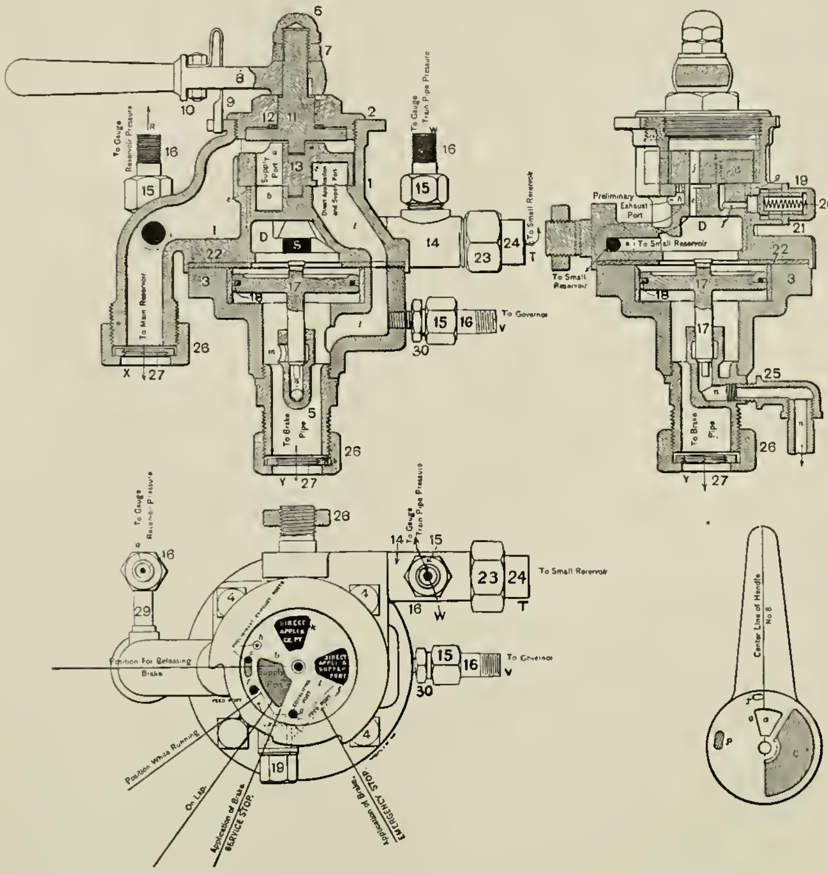
By J. E. PHELAN.

FOURTEENTH PAPER.

This paper treating of the triple valve—retaining and quick-acting triple valve—readers may set it down as a dry roast.

The triple valve is located under each car, close to auxiliary reservoir or brake cylinder, and connected to main air pipe, auxiliary reservoir and brake cylinder by suitable piping.

Triple means three-fold, or probably three of a kind, having similar purpose in principle and work,



which should be carried under running board so as not to confuse the operator.

In handling this valve you do not depend upon hearing escape of air at all, but watch the gauge; reducing pressure above the piston, say eight pounds, will keep the valve and piston up until the pressure below it is reduced slightly below that above, when it will close.

The valve n is so small that the escape of air is slow, no shocks occurring, and the perfect working of the brakes insured.

The small drum contains, say one cubic foot of air, and in setting the brake you reduce the pressure in it ten pounds; if you have one car behind you with one cubic foot of air in its train pipe, as soon as the piston has reduced the pressure below that of the air in the small drum that pressure will close it, and if, instead of the one car, you have thirty, the piston will remain full release position; this is wrong; some claim that they thus have the full pressure in the auxiliaries in case of accident If the pump governor is attached at v, as it often is, only so much air as it will allow to be pumped can be put into the train pipe, no matter where the handle is left, and if it is put at "running position" just as much is put in the train pipe, and 20 pounds extra retained in the drum to insure release.

The *Ry Herald*, London, says the Canadian Pacific are using locomotives with 84-inch boilers —guess the measurement was taken lengthwise.

The London & Northwestern owns and runs 2,500 locomotives; the largest number owned by one road in the world.

will express it better. A triple valve, to look at, is a cast-iron casing attached by piping to main air pipe auxiliary and brake cylinder.

Within this casing a piston valve works; on end of this piston valve rod a slide valve works; within this slide valve a small valve, called a graduating valve, works. Hence a piston valve, a slide valve, and a small valve within the slide valve makes up the combination of triplets.

To chamber, or part of casing in which piston valve works, is attached what is called a drain cup. Within this cup, and located in center, and within a hollow extension of nut in end of drain cup, is a brass stem or rod with a head provided on end, barely entering chamber wherein piston valve travels. Around this stem, and also within the hollow of extension of nut, is a coiled spring. This spring is called the graduating spring, and the stem is called the graduating stem; purpose of both is to assist valve or triple valve on its return trip after setting brakes. The graduating device can be called the triplet's "caller."

The graduating spring and stem perform an important part in light application of brake, as per fourth paper, August, 1888, THE LOCOMOTIVE ENGINEER.

Air pressure reaches the triple valve through main air pipe from main reservoir.

When brakes are released the triple valve is up or toward auxiliary, and pressure from train pipe holds it there, while air pressing on piston valve continues to flow past it through suitable groove inside of chamber wall or face, until equal pressure is gained in auxiliary to that in train pipe.

While triple valve is in this position, the slide valve of triple holds open a passage from cylinder to atmosphere.

To set brakes a reduction of pressure is made in train pipe, this causes less pressure on train pipe side of piston valve than on side nearest auxiliary, and in consequence pressure from auxiliary moves it, and by its movement covers the feeding groove, so that air cannot flow from train pipe to auxiliary, at same time it moves the slide valve in similar movement, and passage from brake cylinder to atmosphere is closed, at same time a passage from auxiliary to brake cylinder is opened, and air rushes from auxiliary reservoir to brake cylinder, and moves piston in brake cylinder in connection with the brake rods, etc., and sets the brakes. See fourth paper.

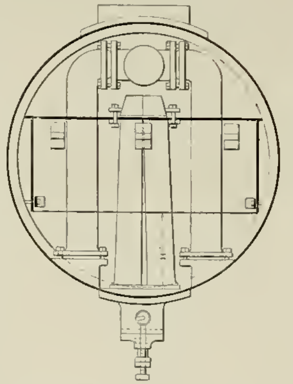
Brakes are released by returning pressure in train pipe, coming from main reservoir, being greater than that held in auxiliary; hence triple valve is forced back to release position, opening passage from brake cylinder to atmosphere, through which air that sets brakes escapes. Piston in brake cylinder then returns to release position, and air from train pipe continues to feed into and refill the auxiliary reservoir for further action.

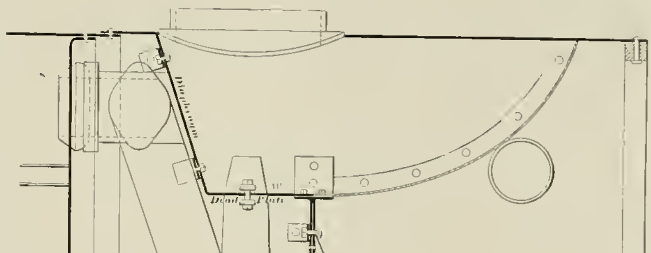
Connected with old style triple valves is what is termed a four-way cock, used for adjusting the brake to condition of service, *i. e.*, when handle of four-way cock is in position parallel with train pipe, triple valve is in communication, as here described, for automatic service. When handle is pointing down, or at right angle with train pipe, the auxiliary reservoir and triple valve is cut out from service, and communication left only with brake cylinder from train pipe—this for straight air. When handle is in position midway between the two positions—the auxiliary brake cylinder and triple valve are cut out, and car in such condition runs without advantage of reliable braking power. In one form of triple valves, four-way cock in midway position serves to bleed the brake to which it applies.

Where the passage from brake cylinder to atmosphere opens, it is called the exhaust port from brake cylinder. Attached to this exhaust port, for brakes used in mountain service, is a small pipe leading to a retaining valve, usually attached to one of the cross-beams of car bottom.

Within body of this retaining valve is a small valve, controlled by a weight, similar in principle to the feed valve and spring of the engineer's brake valve. This valve is cut in for action or cut out by means of a small handle projecting from body of valve. When cut out, handle points down; when cut in, handle should point away from valve body. When retaining valve is in use, air exhausted from brake cylinder in releasing brakes must all pass through the retainer.

When the valve is cut out, a free passage exists through retainer for air to escape, or exhaust from brake cylinder when brakes are releasing.





O. I. & W., FRONT END.

When the retaining valve is cut in and brakes released, action of the retaining valve retains about 20 pounds pressure in brake cylinder, *i.e.*, prevents that amount from escaping into atmosphere. Retaining this amount keeps piston in action, so that brake shoes rest fairly against the wheels, and exert a moderate braking power, while engineer re-charges auxiliaries for renewed action in effective power for stopping.

In ordinary service the retaining valves are not used. In mountain service, before descending grades, they are cut in by trainmen, and when foot of hill is reached they are cut out.

The retaining valves are located, on some roads, near end of platform on passenger cars, so that they can be handled without getting off the cars; on some freight cars they are located near the running board close to roof of car.

When located in such places, and air having to exhaust from brake cylinder through such a long line of piping, there is reason to fear retarded exhaust, and some trouble in consequence.

The retaining valve is applied to both the old style triple valve and new design of quick-acting triple valve, when subject to mountain service.

The new design, or quick-acting triple valve, is identical in form and action, so far as principle and parts stated in commencement of this paper are concerned.

For purpose of acting in conjunction with quick-acting parts, the slide valve of triple valve has a corner cut away from end near auxiliary. Also a port leading into end of slide valve, and out of its side near auxiliary.

The four-way cock is done away with in the quick-acting triple valves, and brakes controlled by this valve can be used for automatic brakes only, therefore cannot be altered for use in straight air practice.

In reality the new triple valve is made up of two sets of triplets. The improvement consists of doing away with the four-way cock, and adding to body or casing of regular triple valve an additional casing or body, containing an additional set of three valves, viz.: emergency valve piston, emergency valve and check valve, and check valve spring.

The main air pipe connects onto this additional chamber or casing, and through fair sized passage feeds directly into drain cup of triple valve, and feeds into auxiliary past piston of triple valve, as described in beginning of this paper.

While train pipe feeds in this direction its pressure also bears against check valve and emergency valve, but does not pass these valves until acted on as described later.

The emergency valve has a leather or rubber seat.

So long as the triple valve is worked by engineer's brake valve to bring small or graduating valve within slide valve into active work (see fourth paper), the action is identical with old style triple valve. When the reduction from train pipe through engineer's brake valve is sufficient to cause triple valve to move, so that part of slide valve corner, cut away for the purpose, uncovers a port leading to emergency valve piston, and air passing through this port, and acting on emergency valve piston, works it down, and causing the piston to act on the emergency valve moves emergency valve from its seat, then pressure in train pipe unseats check valve and flows from the train pipe directly into brake cylinder, past check valve and emergency valve.

The air started in this way continues to flow into brake cylinder until pressures in train pipe and brake cylinder are equalized, when a greater pressure in train pipe ceasing and failing to keep check valve off its seat for passage of air, the check valve automatically closes by action of its spring and auxiliary reservoir pressure, and its closing in this way prevents auxiliary reservoir pressure from flowing back into train pipe, as we understand it, if train pipe should become emptied, etc.

At or about the instant the air flows from train pipe into brake cylinders, the port in end of slide valve—noted before—puts the auxiliary reservoir into communication with brake cylinder also; hence it can be noted that brake cylinder must be quickly filled with air when acted on in this way, and action of brakes made correspondingly quick.

In conclusion, say we reduce pressure enough from engineer's brake valve simply to start the first triple valve in action, and open its port from brake pipe to brake cylinder. The amount flowing into brake cylinder causes so much additional reduction in train pipe pressure, and acts on each and all triple valves in train in proportion to reduction made, and action of each quick-acting triple valve corresponds with action of first one moved.

Arrangement of Deflector Plate and Netting, O. I. & W.

So much trouble is experienced with extension fronts for burning soft coal, that successful arrangements are of interest. While the majority of railroad men think the extension a good thing, it has been our experience that where the road, transportation and mechanical departments are all satisfied, the enginemen were not.

On the O. I. & W. road out of Indianapolis, we found all hands satisfied, and the engines steaming well and throwing no fire, so we investigated. That the division officers were all satisfied went to show that there was no fire, no delays and few repairs; that the enginemen were satisfied proved that the engines steam, do not burn the fronts and required little sparking.

The arrangement of the front end netting and diaphragm are plainly shown in the engraving on page 11. Mr King, the master mechanic, did away with the long netting on top and around nozzles and extended the dead plate above the diaphragm out in front of nozzle, this is hinged to the top plate, which is stiffened by angle irons, and can be swung out and in slightly, thus raising or lowering its lower edge; the apron does not extend to the sides, but an angle piece is riveted there, that supports the apron; the netting is fine, number 10 wire three openings to the inch, the fronts are not sparked at all. One front was opened for our inspection—a passenger engine—that had not been sparked for over six months. We are inclined to the belief that the open stack deserves the credit generally accredited to the extension arch; with it a locomotive will steam with a larger nozzle than with a diamond stack. The Webb compound steams with only one light exhaust to a revolution, using a short front, open stack and open pipes to carry off cinders.

Different grades of coal make all the difference in the world; the coal used on the O. I. & W. crumbles up very fine; on some roads, using coal that makes a hard cinder, the fronts would fill up. The object of the front is to catch sparks; if they will wear out and go out through a fine netting with an extension, they will do so without it.

An Irish Catastrophe.

On the 11th of June a train on the Great Northern Railway of Ireland, containing 1,200 members of a Sunday-school, met with an accident through the criminal action or inaction of those in authority, resulting in the slaughter of seventy-four, and the crippling of nearly a hundred. We do not remember of ever reading of another wholesale slaughter where there was not some shadow of an excuse—some unforeseen complication that led up to the wreck. In this wreck not only was there no such mitigating incident, but every precaution that could be invented was used to further the awful sacrifice of life.

The excursion left Armagh in three trains, a few miles from that place, where a heavy grade is ascended on a fifty foot fill. The second section was stalled—the train being much heavier than the engine was capable of pulling; here several cars were cut off and held by stones chocked against the wheels, and the engine proceeded to "double"; the lone cars started back down the grade, crashing into the third section with the results stated above. The people were locked into the compartment cars, or nearly all could have got out and off while the train was starting back at a slow speed—many did break the windows and escape in that way. The engineer, with the front of the train, tried to catch the runaway cars, but the crude devices they use in that country prevented their coupling on—automatic couplers would have saved the train.

Automatic brakes would have saved them if an intelligent "guard" were in charge of the lone cars.

Of course they have arrested the guard, the engineer and fireman, and the traffic manager's clerk, as responsible. What they ought to do is to arrest the officers who are responsible for the lack of modern appliances of safety—carrying a sack of powder through the public streets in one hand, and a lighted torch in the other, should not be tolerated.

Scotland Yard detectives are searching for the murder of a few fallen women in Whitechapel—why not look for the murderers of these little children—for murderers they are.

If the people of Great Britain need any stronger argument against their compartment hearses, and for automatic brakes and automatic couplers, than that written in the blood of the children of Armagh, they are welcome to it.

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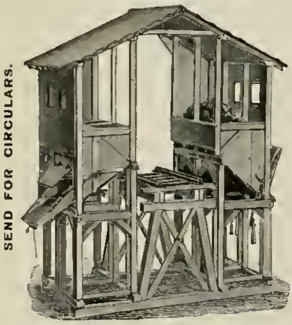

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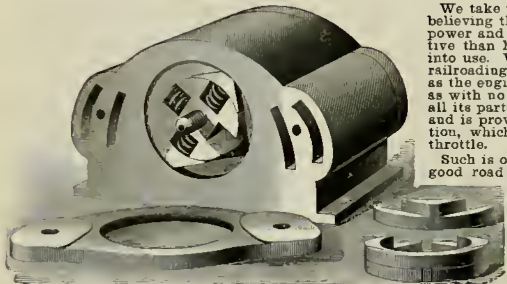

We take pleasure in presenting this Valve to Railroad men and others, believing that its use on a Locomotive Engine will effect a greater saving of power and expense in the maintenance of the working parts of the Locomotive than has been accomplished since the Locomotive was first brought into use. We also believe that its use will add largely to the safety of railroading, and prevent the destruction of many lives and much property, as the engine can be reversed as easily with 160 lbs. pressure on the Valve as with no pressure, it being a **Perfect Balance Valve.** The Valve in all its parts is as durable as any of the working parts of the Locomotive, and is provided with a relief device, simple in its construction and operation, which relieves back pressure instantly when running with closed throttle.

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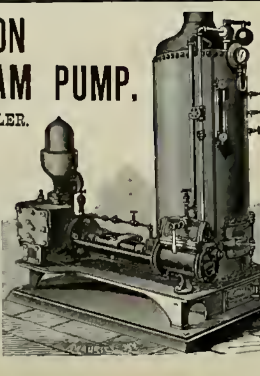

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No service on a locomotive sufficiently severe to permanently stop its working.

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should the Jet break from interruption of the steam or water supply, as soon as the supply is resumed.

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to varying steam pressures without waste of water. Increases quantity of water with increase of steam, and vice versa.

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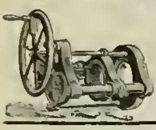
Patent Portable Locomotive Cylinder Boring Machine.

Will bore out Locomotive Cylinders IN THEIR PLACES by removing one or both heads, as desired, and piston. THE END THRUST IS ALWAYS IN EXACT LINE WITH BAR. It is fed with constant feed of cut gears.



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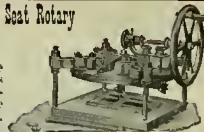

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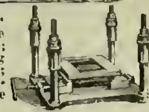

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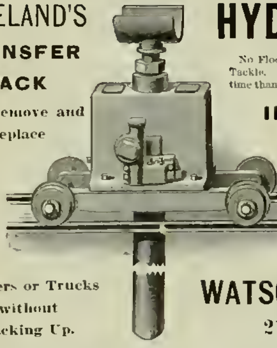

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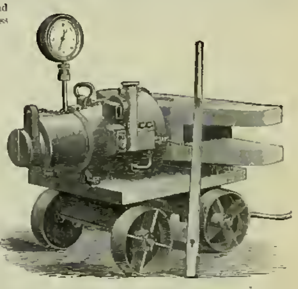

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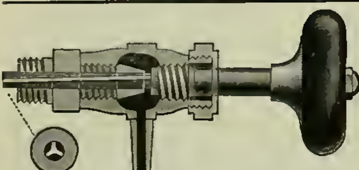

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Every movement of the handle cleans out the tube. A bronze valve on a brass seat. Will not leak. Valve seat readily taken out for examination or repairs. Heavy, well made and adapted for the severest locomotive service.

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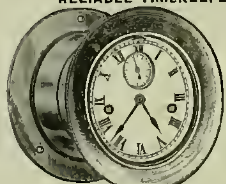

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It is but the work of a moment to balance the top roll and lower the hinge housing to take out the plate when a full circle is bent. The rolls are all made of solid wrought-iron, the balance bar being a part or extension of the top roll. There is a cast-iron bedplate under the entire machine. To save any shifting of belts we put in Friction Pulleys which enable the rolls to be started, stopped or reversed instantly.

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VOL. II, NO. VIII. NEW YORK, AUGUST, 1889. 1.00 per Year. or 10c. a copy.

Historical Locomotives.

NINTH SKETCH.

On this page will be found an engraving, taken from the original drawings, of another historical locomotive that had the distinction of being the first of a species of locomotive engine now very popular in America—the ten-wheeler. This locomotive was built for the Philadelphia & Reading Railroad, by Norris Brothers, in 1847.

It was invented and patented by Septimus Norris, a brother of Richard and William, and the author of several engineering works.

It was thought by many that the engine would not keep the track, but she did, and the Pennsylvania Co. at once ordered twenty of them. The engine was called the "Chesapeake" and ran in the shape shown until 1862, when she was rebuilt into an anthracite coal burner by Jas. Milholland, then M. M of the Reading road, she got a new boiler, but much of the old engine was used; in 1878 she was cut up finally. The Norris independent cut-off was employed, the reverse lever and the cut-off lever being shown as standing together.

The side rods were simply two round rods of iron that extended through guide backs each side of the brasses, and provisions to take up brasses and change length of rods is plainly shown.

The side rods were in two sections entirely independent of each other and the main rod connected to main pin between the two sections; this style rod was much used in those days by Norris as well as by Ross Winans, of Baltimore, and other builders. It will be seen that the drivers were without counterbalance. The barrel of the boiler only was lagged, no jacket used. At the time this locomotive was built it was considered necessary that the driving boxes should be a very nice fit in the jaws of the frame, and to keep the axle in contact the full length of the box when one wheel raised up on the tack. A peculiar and expensive set of driving boxes were made for this locomotive. The sides of box were independent of the bearing and fitted simply the jaws, the box part being pivoted to them by large, short trunnions forward and back, the spring saddle was a rocker that could roll on top. The idea was that the inequalities in the tack would let the box have great freedom of movement without the necessity of lateral play or loose fits between box and frame.

The following data were taken from the books of the Norris works:

ENGINE AND TENDER "CHESAPEAKE."

The first 10-wheeled engine ever built.

Tried in shops March 15, 1847.

Placed on road March 19, 1847.

Boiler, 44 inches diameter.

Fire-box, 37¼ inches square inside. Height from grate to crown, 50 inches. Upper surface of grate bars, 17 inches from rail. 2½ inches water space on throat and 2 inches around sides, which will extend down to form ashpan.

Cylinders, 14½" x 22"; 6 feet 8 in. center to center; flanged drivers, six, 46 inches diameter; axles, 5 inches diameter.

Truck, 4 wheeled, 26" diameter; axles, 4' diameter.

Tender, 8 wheeled, 30" diameter, axles, 4 diameter.

133 tubes, 2 inches diameter, 12 feet long.

Pumps under cylinders worked by arm from piston rod.

Wrought-iron rock arms, bearings inside of frame.

Frames straight from end to end, pedestals fitted with wedges and vibrating boxes.

Sand-box with copper pipes 2 inches diameter leading in front of drivers.

Roof extending from front of dome to extreme hind of platform, with wrought-iron columns.

Whistle on engine.

Bumper after plan of company.

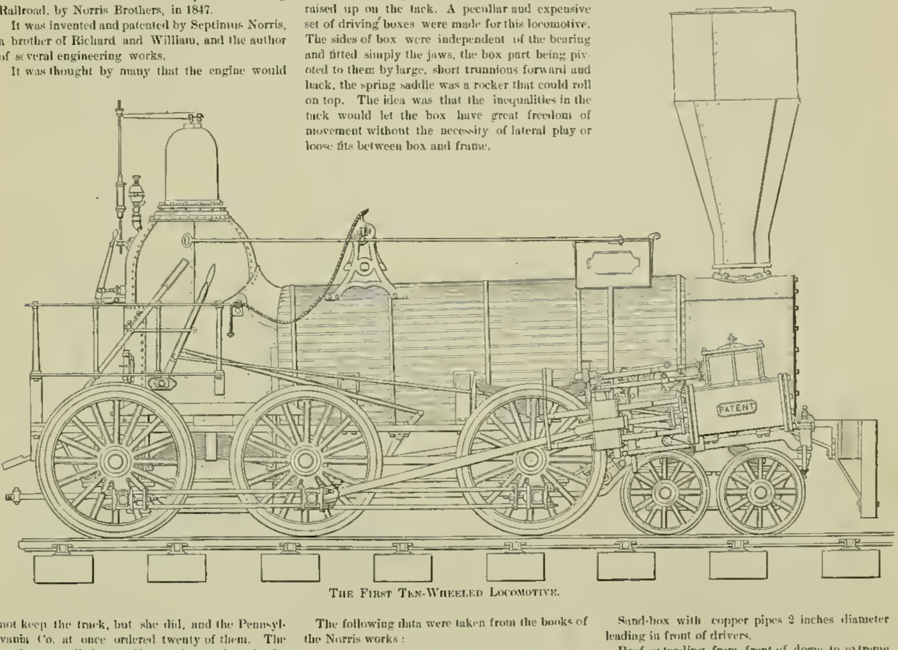
Smoke-pipe after plan of company, 14 ft. 3 in. from rail.

Tender held 2 cords wood and 2,000 gallons water.

Platform on each side of engine.

Duty To haul 100 loaded coal cars weighing (without engine tender) 710 tons of 2,240 lbs., with the wood as used for fuel on the road.

Weight of engine with wood and water, 44,074 lbs.



THE FIRST TEN-WHEELED LOCOMOTIVE.

Collar Fastener for Solid Rods.

On the Philadelphia, Wilmington & Baltimore road they use solid-ended rods on what appear to be common pins with solid collars. The collar fastening used is the invention of and was patented by Master Mechanic H. D. Gordon, and is shown in the engraving.

In some cases he uses a screw-headed bolt and a loose collar, but prefers the solid bolt and collar as shown. The pin is counterbored at the back end, so that the nuts do not project beyond the inside surface of the wheel.

The device is cheap, strong and neat. The usual thick collar, with a huge split key through it, is unsightly, hard to clean, and hard to get off in case of breakdown on the road.

A New Grease Cup.

The use of a heavy grease in place of oil for crank-pins, guides, eccentrics, etc., is coming more and more into use, the heavy grease having some peculiar advantages over oil.

We illustrate on this page a new rod cup, designed to feed heavy grease and now in use on several lines of road. The usual method with grease cups is to have a piston fitted on top of lubricant, with a spring to force it down, the tension on the spring controlled by a screw, the trouble with this device was that it took time to handle the screw, which required running clear out to admit of refilling, and the runner never knew what the cup was doing.

In this cup the plunger is not removed to fill, the cup opening at the bottom, thus it can be tighter, the spring can be compressed by shoving down the small handles shown at the side, and locked in any of the three degrees of compression instantly, and can be relieved from pressure at end of run by simply twisting handles out of notch.

The piston carries a cap above the handles in the upper case, that always shows how much grease is in the cup.

The regulating plug—set with a screw-driver—is in the shank, and the hole is so much smaller for grease than for oil and a feeder, that the shank is stronger—a desirable feature.

The construction of the cup is plainly shown in the cuts. They are made by the Lackawanna Lubricating Co., Scranton, Pa., who will furnish any other information desired.

Indicating Locomotives.

THIRD PAPER.

BY CYRUS F. RICHMOND.

Having named the various lines and explained their meaning, it will probably be of interest to study the lines of a card that was actually taken from a locomotive, and note the difference from the regular lines and sharp *points*—for that is a term applied to the beginning and ending of the various lines—shown in July issue of THE LOCOMOTIVE ENGINEER.

We will select a card that can be easily read; that is, the *points* are sharply defined.

Fig. 3 is a copy of a diagram taken from a locomotive when running at 84 revolutions per minute, boiler pressure, 132 pounds; No. 80 spring being used in indicator; reverse lever in fourth notch, which in this case cuts off the steam, or rather, valve closes the steam port when piston has traveled about one-half its stroke.

It will be remembered that the height of diagram from the atmospheric line represents the pressure of steam, and the length corresponds to stroke of piston. So we start from the point *A*, which is about the place that the valve commences to open for the lead—the vertical lines representing the ends of stroke—the pressure rises rapidly, for at this point in the stroke of piston the eccentric has its greatest throw, and consequently moves the valve quick and opens the steam port quite wide.

The pencil having reached the highest point the conditions will permit, at 1½ inches from atmospheric line, we know from number of spring used that the *initial pressure*—that is, steam pressure in cylinder at beginning of stroke of piston—must be 120 pounds, which is maintained for about 1½ inches of stroke of piston. Then we notice a gradual falling, which is due to the gradual closing of steam port, and about at the point *B* we notice quite a sudden drop. Here the valve has entirely closed the port,

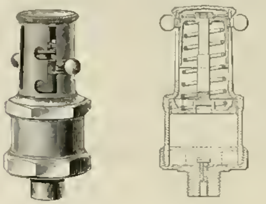


Fig. 1 *Fig. 2*

A NEW GREASE CUP.

and steam is being used expansively until it reaches the point *C*; here we have another sudden drop, and this is caused by the valve opening the exhaust port and allowing the steam to escape to the atmosphere, but it will be seen that the exhaust did not open early enough to allow all the steam to escape, and there is about 17 pounds pressure per square inch, tending to retard the piston at the beginning of back stroke, although the exhaust port still remains open, all the steam does not escape, and

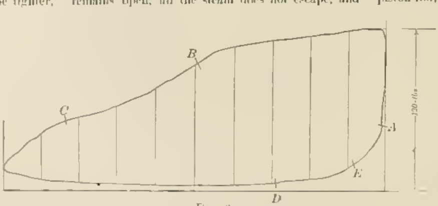
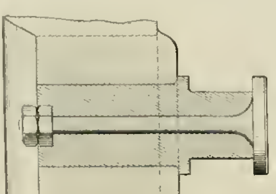


Fig. 3

INDICATING LOCOMOTIVES.

the back pressure reaches as high as four pounds.

At the point *D*, the valve has commenced to close the exhaust, and as all the steam ahead of piston did not escape, it is being compressed into a smaller space, consequently causing the pressure to rise. The exact point at which the valve closes the exhaust cannot be determined easily, but we should judge it to be about at the point *E*, as at this position of the reverse lever—fourth notch—the exhaust port is closed when piston has traveled about 19



COLLAR FASTENER FOR SOLID RODS.

inches of the back stroke. The compression continues to the point *A*; therefore the curved line from *D* to *A* is called the *compression line*.

Now, by a little reflection, it will be clear that the space or area enclosed by the diagram in Fig. 3 represents the pressure or force urging the piston, which in turn communicates motion to the wheels and performs work. What we wish to determine is the average amount of this pressure during a complete revolution of the engine, so a diagram is taken from each end of cylinder, and the average pressure of the two diagrams is used in computing the horse-power.

There is an instrument made called a planimeter, which will measure the areas of irregular figures, but it is not always easy to obtain such an instrument, and the mean or average pressure must be obtained by dividing the length of the diagram up into any number of equal parts—usually 10 is chosen—and then erecting perpendiculars, or, more properly, ordinates, through these points of divisions. Then by carefully measuring the length of each of these lines, and adding the measurements together, then dividing the result by 10, or the number of divisions in the card, the desired result will be obtained.

In measuring the length of these lines a scale must be used that corresponds to the number of spring that was used; for instance, if the cards were taken with a No. 80 spring then it will be necessary to measure the ordinates with a scale that has 80 divisions to one inch. Such scales are usually provided with the indicators.

An easy method of obtaining the length of these lines has been suggested, and, with a little care, is quite as accurate as measuring each line and averaging the result.

Take a strip of paper and lay off one after another the several distances. Then measure the whole length at once with the proper scale, and divide the measurement by the number of divisions or spaces. Only *one-half the sum* of the first and last lines should be used. It is best to lay off the length of the end lines first, and take one-half of this measurement; then no error will arise in the calculation.

Having obtained the mean effective pressure, diameter of cylinder, stroke of piston, diameter of piston rod, number of revolutions per minute, we have all the data necessary to compute the horse-power. For the product of the mean effective pressure expressed in pounds per square inch, the net area of the cylinder, in square inches (by the net area we mean the area of cylinder minus one-half the area of piston rod), the length of the stroke in feet, and the number of strokes per minute (which is twice the number of revolutions) will give the number of *foot pounds* of work done in one minute, and as the old rule goes, 33,000 pounds raised one foot high in a minute is one horse-power, we divide the product of the foregoing by 33,000, and obtain the horse-power. Thus: Mean effective pressure, 94 pounds; net area of cylinder, 250.93 inches; stroke of piston, 2 feet; number of strokes per minute, 168. Combining the last two we obtain a piston speed of 336 feet per minute. Then

$$\frac{94 \times 250.93 \times 336}{33,000} = 240.16 \text{ horse-power.}$$

The method of marking out the ordinates is shown in Fig. 3. Variations from this will be shown in another paper.

In another column will be found illustrations and description of a novel speed-recorder for use while indicating locomotives. Mr. Wootten seems to have done away with the nuisance of stop-watches or other timepieces that have to be watched, stopped the ever-present chance for grave inaccuracies in counting, and provided for a written record of the exact speed for every card taken. The instrument can be located in the cab or on the front end, and not only tells the speed, but denotes a slip as well. Perhaps Mr. Wootten will use this little instrument to give us some reliable data on the alleged "imperceptible slip."

President Briggs, of the Master Mechanics' Association, is a prompt officer, he has already announced by special circular the committees for the following year. There are eleven live subjects up for next meeting—and not a chestnut among them.

The N. P. Ry. furnish their engines with a large combination pipe wrench, a handy thing in breakdowns. There are many roads that will not furnish monkey wrenches and red flags, let alone anything for the convenience of the men.

Combined Hose Coupler and Stop-cock.

At the master mechanics' meeting this year there was exhibited a new air-brake hose coupler, the invention of J. H. Porter and E. A Grosvenor, two engineers on the Michigan Central Railway.

The object of the invention was to avoid the possibility of trainmen forgetting to open or close the train pipe cocks—as is often done

Their improvement consists of a turret ported valve held in the brake-head, and operated by a lever. The valve is slightly tapered, and is held to its seat by a coiled spring around the stem, as shown in Fig. 3.

To couple the hose it is necessary to hook one of the notches in the curved lever upon the pin of the other lever—no difference which one—and then bring the heads together and couple them, same as is necessary with the old head. In doing this the cocks are opened, and the heads cannot be coupled unless they are opened.

To uncouple, the heads are "broken" by twisting upward same as of old, and before the heads are apart the valves are closed. If, however, a straight and strong pull is made on the hose, as is done when trains part, the heads will pull apart, leaving the valves open and thus setting the brakes. Fig 2 shows the position of levers when coupled.

The improvement does away with the cocks in pipe at each end of car, and, as they can be applied to common hose heads by screwing into the place of the present cap that holds the gaskets, it ought to be cheap and easily applied.

There are few engineers who do not know of "circumstances" caused by forgetting the cocks in train pipe, and we believe that our brother engineers have got around the difficulty, and added another safeguard to the greatest of all safeguards of our railway system—the Automatic Air-brake.

This device has been in use for the past nine months on the Michigan Central road, we are informed, with perfect success.

A Generous Proposition.

The *Railway Herald*, of London, Eng., has the following:

"It is an unfortunate fact that the railway men found guilty of culpable negligence by the coroner's jury, at the inquest on those killed in the Armagh disaster, are none of them members of any society or trade union which can afford them legal assistance on their trial. The reason for this is not far to seek. Irish railway men are, of all those of their class in the United Kingdom, the worst paid, although it may be truly said they are not, as a rule, the hardest worked.

"As these men are not in a position to afford the necessary outlay to pay for their own defense, we think it only right to do everything in our power to insure them a fair hearing at the trial, and that every point that can be urged in their favor shall be placed before the jury by a skilled advocate.

"With this view we have decided to open a subscription list in these columns, to which we confidently invite, on the ground of common interests, subscriptions from all grades of the service in the kingdom, as well as from those either directly or indirectly connected with railways."

This goes a little further than American orders do. We think we are doing nobly if we are just to outsiders, let alone being generous.

The Pennsylvania seem to be having their share, and more too, of accidents, the details of which are published This road has always had as many accidents, in proportion to number of train miles made, as the average of roads, but have always been able to keep all mention of them out of the press unless some one was killed.

Too Much of a Good Thing.

Eugene V. Debs, Grand Secretary and Treasurer of the B. L. F., and editor of the *Magazine*, paid us a call on a recent visit to New York.

If Bro. Debs was not a little more popular than J. L. Sullivan, we might get a chance to talk to him a few minutes when he comes to town without a gang of railroad men blockading the stairs for a chance to shake hands with him. We never want to get as popular as Debs is; when we get so popular that we can't go quietly into a cheap restaurant and enjoy our stewed giblets and liver without a host of admirers insisting on standing behind our chair and fighting to see who will fill our coffee cup with champagney water, or pin button-hole bouquets on us, we are going to crawl off into the seclusion of private life.

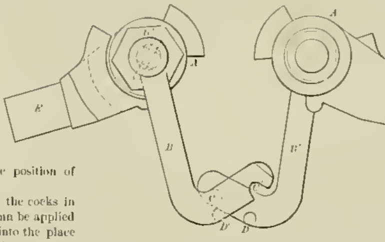


Fig. 1

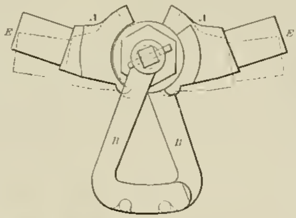


Fig 2

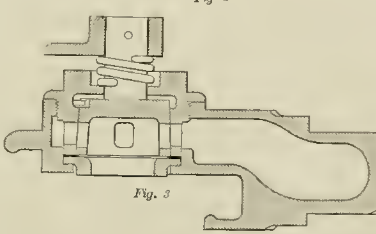


Fig. 3

COMBINED HOSE COUPLER AND STOP-COCK

White flags soon become gray, then black; red becomes brown, then brindle; so that, in order to use up the bunting, it is necessary that engineers should not be color-blind to any of the *symptoms* of red or white or green. Sheet-metal flags do not wear out, wind up on the staff, change color or blow away why don't you make some sheet-iron flags?

Some miscreant who was concealed in the bushes fired a shot at a passenger train on the Chicago & Northwestern at Coon Siding, Iowa, July 7, and the bullet struck engineer Henry Barron in the face, breaking his jaw. The plucky engineer remained at his post, however, until he reached Boone, Iowa, 25 miles distant.—*Ry. Age.*

Many of the Pennsylvania engines have black-faced steam and air gauges with white painted pointers, figures and graduations, they look neat, and the figures are easily seen.

A Fast Run.

We have received the printed record of a fast run on the Pennsylvania Limited from Ft. Wayne to Chicago, on May 19, engine 200; engineer, John S Christie; fireman, E. E. Crawford. Train consisted of five cars, weighing 438,500 pounds; engine weighed 91,900 pounds, 18x24 cylinder, 62-inch drivers. The road has many grades and curves, and the distance is 148.3 miles; it was made in 2 hours 59 minutes, including stops, actual running time, 158 minutes. Average speed, running, 56.3 miles per hour. The fastest run was 6.3 miles in 5 minutes 20 seconds, or 71 miles per hour

We are pleased to note that the last legislature of Michigan appreciated the efficient services of the engineer on the board of railroad commissioners enough to raise his salary handsomely. Brother Conger is worth every cent he gets

You have just got metallic packing all around; well, have you got anything to hold the valve stem in case you have to disconnect? Remember, you can't cramp the gland

Engineer John Heath, of the Northwestern, has been in the service of that road for nearly 30 years; has made 93,658 miles as fireman, and 905,117 as engineer, without an accident.

The U. S Metallic Packing Co. have favored us with a bird's-eye view of their exhibit at the Paris Exposition.

Correspondence

Where Was He Brought Up?

Editor The Locomotive Engineer.

When I read the statement in italic, near the close of Mr. E. J. Rauch's article in the July number, the above question immediately presented itself to my mind. I am not an "old timer," neither do I wish to appear smart; but I will guarantee that I can take a 2-inch flat spot out of the tread of a tire inside of sixty days, on any road in the Northwest during the winter months, with plenty of snow to "buck." And if I did not want a sure thing I would say it could be done in thirty days. If Mr. Rauch wishes to see some enginemen who have seen flat spots worn out, I can give him letters of introduction to perhaps twenty-five men who have seen the thing done. I have also known of instances where flat spots on truck wheels, caused by sand holes and chill blisters, have disappeared by wear.

Chillicothe, Mo. A. H TUCKER.

Who is Keystone?

Editor The Locomotive Engineer:

I notice a letter in your paper of this month signed Keystone, trying to make fun of a sand bell, but don't know how, simply because he is not posted on what he is talking about. I cannot believe this man to be an engineer, as wide-awake engineers never condemn a thing until they are sure they are right.

Now Mr. Keystone is off his base on this sand bell The sand bell he claims to have had on his mill has a plug inside, and is made by the Penna. R. R. Co at Altoona The cut shown in your May number is not the same kind and does not throw sand to the *queen's taste*, but places sand on the track, as it should be, and does not clog at all. Neither does it require a *special brand of sand*. Now, Mr Keystone, let me hear from you.

JAMES REAGAN

Germantown, Philadelphia, Pa.

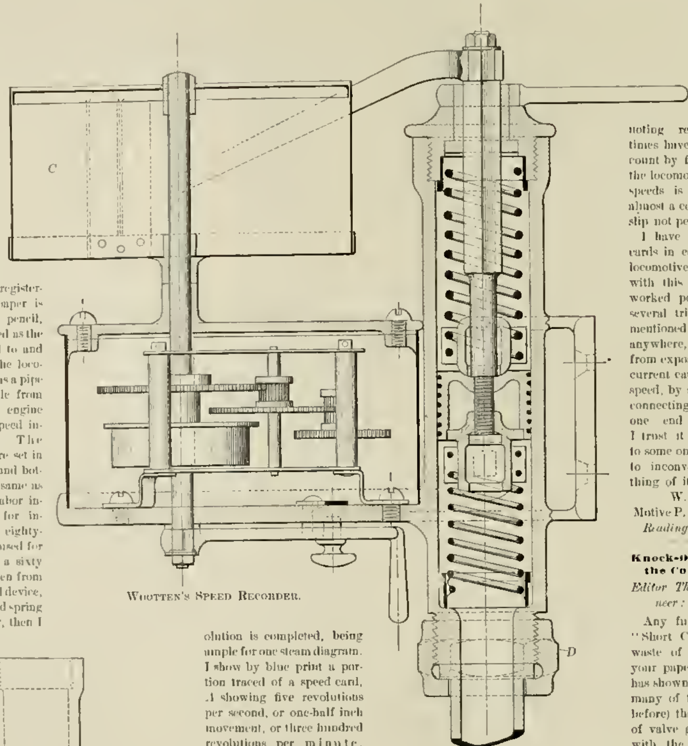
Locomotive Speed Indicator.

Editor The Locomotive Engineer :

I enclose herewith blue print of a speed-registering device, which I have designed, and been using successfully on the New York and Philadelphia division, (Bound Brook) of the Philadelphia & Reading R. R., while indicating high speed locomotives in passenger service upon that division. The device is not a patented one. It is of cast-brass of plan shown in cuts, with clock work to move the paper drum *C* circumferentially one-half inch per second, thus obviating the necessity of using a stop-watch. A strip of paper is placed around the drum in the same manner as that upon a steam engine indicator. The registering upon the paper is made by lead pencil, raised and lowered as the steam is admitted to and exhausted from the locomotive cylinder, as a pipe connection is made from one end of the engine cylinder to the speed indicator at *D*. The springs shown are set in loosely both top and bottom, and are the same as carried in the Tabor indicator box, as for instance, if an eighty-pound spring is used for Tabor indicator, a sixty and twenty is taken from the box, for speed device, or if a sixty pound spring is used in Tabor, then I use a forty and twenty for speed. A handle to rewind the drum spring, as well as a button to start the movement, is shown under the clock-work, and also in Fig. 5. After about three-quarters of a revolution of the drum is made, it stops automatically, to prevent the pencil point from coming in contact with the spring holding the paper upon the drum, as well as to obtain absolute uniform movement, not depending, therefore, upon the escapement to regulate the difference due to change of tension upon the clock spring, other than one revolution. The paper used is cut into strips eleven inches long by one and three-eighths wide and placed upon the drum by an assistant, located on the running board or in the cab; at the same time the paper is placed upon the engine indicator, and speed record and steam diagram are taken at the same moment, a full quarter of a minute being the maximum time to operate the speed indicator before its portion of a revolution is completed, being ample for one steam diagram. I show by blue print a portion traced of a speed card, *A* showing five revolutions per second, or one-half inch movement, or three hundred revolutions per minute, equaling sixty-one and two-tenths miles per hour, for a wheel sixty-eight inches in diameter. The portion of speed card shown at *B* indicates slip, as the increase of speed is abrupt, a gradual increase of stroke or speed is shown on a full length of paper by a gradually diminishing distance between the lines until speed is uniform. In the case of card *B* the engine diagram was condemned, due to this slip, which is an important factor and cannot easily be determined by such devices as are at times used for high-speed locomotive indicating. There can be no loss of count or incorrect registering by this means, as the upward stroke is recorded when steam is admitted to follow the engine piston, and, when exhausting, the speed indicator piston returns to its fixed position, thus completing one revolution. Indicator and speed cards are correspondingly numbered and filed, and speed obtained when convenient to do so. My experience with speed devices has shown skipping of teeth, very close attention to its working correctly, and the additional labor of caring for the stop-watch when noting revolution, and at times have been compelled to count by fours the exhaust of the locomotive, which at high speeds is unreliable, being almost a continuous blast, and slip not perceptible.

I have now original speed cards in connection with my locomotive indicating taken with this device, which has worked perfectly during the several trips. As previously mentioned, it may be placed anywhere, inside the cab away from exposure and the strong current caused by the engine speed, by simply running the connecting pipe back from one end of the cylinder. I trust it may be of benefit to some one who has been put to inconvenience for something of its kind.

W. F. WOOTTEN,
Motive P. Dep. P. & R. R. Co.
Reading, Penn.



WOOTTEN'S SPEED RECORDER.

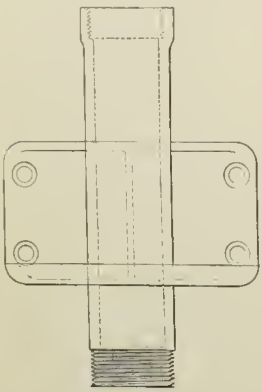


Fig. 4

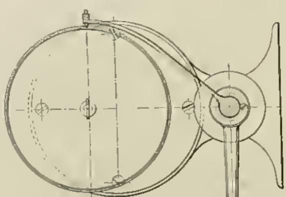
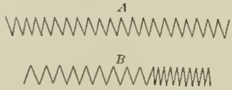


Fig. 3



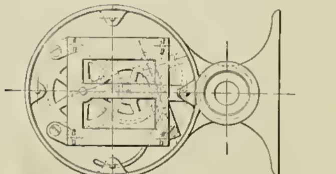


Fig. 2

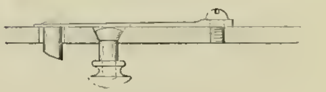


Fig 5

Knock-Out Arguments on the Cut-Off Question.

Editor The Locomotive Engineer :

Any further discussion on "Short Cut-off" will be a waste of valuable space in your paper, since "Vulcan" has shown your readers (which many of them did not know before) that a "Corliss type of valve gear" was *identical* with the *link motion*, and should be handled the same! Also he states that when his train is too heavy to pull with cut-off at 7" and is compelled to use the 9" cut-off, that his engine uses more water than when cutting off at the 7" notch! Such "proof" as this will stand; and he further states that there is not any vacuum in the cylinders, when the throttle is partly closed (as most of us have always thought), and that there is the same amount of steam goes into the cylinders when partly closed as when wide open! Now the only thing that is in the way of always running an engine "correctly" is a failure to get a "*square exhaust*" for a "trained ear"! Could this not be overcome by his using square nozzles, same as the engines on the P. P. R?

Now, Mr. Editor, when you get hold of such facts as these, why not throw up the sponge, and admit your defeat manfully? The writer has met with a change of heart; in fact, converted to the *new faith.*

Would you be good enough to ask my old friend, E. J. Rauch, if the flat spots on the driving wheels of the "Swinerton" engine give more adhesion when flat on the rail, what about the adhesion when not flat, or during the time of one leaving the rail and the next one getting there? Also what per cent. of the time does the "little facet" have to get in its work? Do not for a moment think that any one doubts the correctness of his statement, but would like to know how it was done! See? NEW FAITH

Germantown, Pa.

Back Pressure and Full Throttle.

Editor The Locomotive Engineer:

Grant's letter in May number pleased me very much. He says he is only a fireman and not supposed to have any opinions. I am one, and his opinion of this full throttle question is the same as mine. I have been on the footboard with a great many different men. Give me the full boiler pressure in the steam chest. If I was M. M. of a road I would have an automatic device whereby the steam gauge would be connected with the steam chest the moment the engineer placed his hand on the reverse lever, closing connection to gauge on boiler until she was shut off again. I would place this on every engine that was being run with reverse lever down amongst the oil cans.

Some of the 20-year old engineers would say we can't run them. They said that when injectors, sparkers, lubricators, and the many other improvements we have at the present day were put on. They talk about back pressure. I admit there is such, but it is back up in the boiler, and they won't let it down there to do the work economically. I believe if the exhaust was muffled, some men would drop them down, and try to knock it off, so they could stick their heads out of the window and say to the fireman, "Hear her bark; pretty square, ain't she?"

I have got a 19x24 Baldwin mogul; I can hear her bark at the furnace door all I want to.

Now about working steam expansively, if all locomotive engineers knew what it meant we would have no trouble with it. Stationary and marine engineers have settled it. The late George Corliss made a fortune by it. Instead of having the governor to control the valves, we have the engineer and those who understand what working steam expansively means; see how others abuse it. Not one locomotive engineer in 500 knows what you mean when you are talking about the expansive working of steam. And not one in 1,500 can read an indicator card. If locomotive engineers would study this subject we would have better men and smaller coal bills. I have books on the subject of indicators, planimeters, etc., that I will gladly loan to any locomotive engineer, and teach him the use of same. I lent Pray's second volume the other day to one of our engineers; he brought it back, and said I might as well have given him a Latin grammar. We have too many of this class of runners in the country (for runners we must call them, they are not engineers,) that have been set up on account of long service. In marine and stationary service it is not long service, it is knowledge that counts, and if we had a little more of it on R. R's we would have no trouble about "full throttles" and spoon-shaped valves. Men will say we do not have time to study, long runs and the like. I will say to them I have a long run—190 miles—over one of the worst roads in New England, and a night run at that; average consumption of fuel nightly, 5 tons. I find a little time to look into this matter. Hoping we may do some good to some one, I say to Grant, fire away, I will help you out.

Worcester, Mass. ARNOLD.

[This fireman's wholesale charge of ignorance of locomotive engineers is no doubt based on what he sees around him. We admire this correspondent's grit and independence, but his argument would be better received by the average engineman if he made it a little more modestly.]

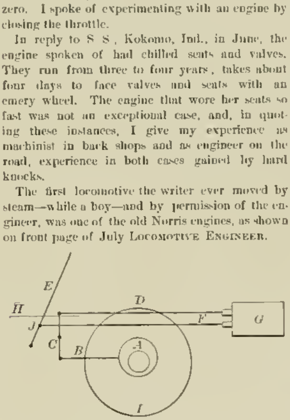
Odds and Ends.

Editor The Locomotive Engineer:

In reply to Vulcan, in July, I suppose John Alexander and myself have put our foot in it. Figures and theories are one thing and road experience is another. I know some very good engineers who don't go a cent on the center notch and full throttle business. We know that the ordinary slide valve is cheap to make, but it is a very poor substitute for the Corliss valve, and stands no show when the Corliss valve is pitted against it. Get up a valve gear for locomotives with an independent exhaust, and only then will comparison be in order. When I speak of the center notch, I mean the notch next to the zero notch, allowing that the valve has no opening *at* zero, although I have seen engines running or *trying* to run with the lever at zero. I spoke of experimenting with an engine by closing the throttle.

In reply to S. S., Kokomo, Ind., in June, the engine spoken of had chilled seats and valves. They run from three to four years, takes about four days to face valves and seats with an emery wheel. The engine that wore her seats so fast was not an exceptional case, and, in quoting these instances, I give my experience as machinist in back shops and as engineer on the road, experience in both cases gained by hard knocks.

The first locomotive the writer ever moved by steam—while a boy—and by permission of the engineer, was one of the old Norris engines, as shown on front page of July LOCOMOTIVE ENGINEER.



OLD VALVE MOTION

In the early days, Eastwick & Harrison, of Philadelphia, built three locomotives for the Philadelphia & Columbia Railroad, at that time owned and operated by the State of Pennsylvania, at present the Philadelphia Div. of the P. R. R. These engines were flyers running ahead, but did not back up first-rate. The drivers were a single pair, placed in the rear of firebox. Will some of the old locomotive experts explain their valve gear through the columns of THE LOCOMOTIVE ENGINEER? I send a line sketch of the valve gear as I saw it in my boyhood days, and must rely on my memory. The eccentrics were single, or only one for each side, and keyed fast to the shaft, the ends of the eccentric rods had strap and brasses to connect to lower end of rocker arm (no hooks of any kind). There were two valve rods for each chest, as shown in sketch, two reverse levers, one for each side of the engine, but both located on the right-hand side of the engine for convenience, and passing down through the footplate, where the lower or reversing valve rod connected to them. While running ahead the two levers were thrown forward, and held in that position by a spring catch operated by the foot of the engineer, in moving the levers forward the lower valve stem was carried with it by virtue of the connection at *J*; these lower rods remained stationary while running. To reverse the engine the engineer put his foot on the spring catches, pulled both reverse levers back when the catch would hold them in that position. *A*, eccentric; *B*, eccentric rod; *C*, rock arm, *D*, valve rod, *E*, reverse lever; *F*, lower or reversing valve rod, *G*, steam chest; *H*, foot plate; *I*, driver, *J*, connection of reverse lever and lower or reversing valve rod.

These engines were not reversed by the eccentric, but by manipulating the lower valve rod; now, what mechanical business was in the steam chest is what we want to find out. W. DE SANNO.

Tulare, Cal.

"From the Western Land."

Editor The Locomotive Engineer:

Mr. De Sanno's statement regarding the valve seat being rapidly cut away and disappearing at the rate of ¼ inch in a trip of 214 miles, prompts the writer to inquire if the valve was balanced. There is much truth embodied in his statement, that a man in charge of a shop or roundhouse should be able to take an engine out on the road, and run her intelligently after being rebuilt, if necessary. If such men were more plentiful, and doubting the statements of engineers, or differing materially with the "higher authority" who proposed to have a questionable engine haul 40 loads over a hilly division (or bribe some engineer to "screw her out" 25 pounds and do it), he could settle the matter himself by going over the road a trip on her with a good fireman. De Sanno's ideas of a tight ash-pan are well founded; many dampers could be hung in the center (similar to a common stove damper), thus avoiding the wholesale cutting out of pieces here and there to make them clear some of the machinery. Labor spent in this direction is only equaled by a good job of boiler washing. "Old Fogy" is not slow, if he is a reader of the *Master Mechanic*, we imagine we ought to sympathize with him in his possible folly, his contribution is convincing that he never let much moss accumulate on his back.

There may be whole lots of engineers that are moss-backed in Germantown; he is probably not one of this kind.

The "*Vulcan*" signature always attracts attention. He is quite correct in his pump observance. We frequently hook up the lever a notch, when possible to do so, rather than change the pump feed. It saves fuel, and adds an inch of water to boiler in comparatively short time or distance. Do not your comments on Vulcan's article substantiate what Kingsland says regarding the "old Lawrence" engines Nos. 11 and 12 on the St. Paul: "*They could run faster with less steam before they were rebuilt, and links substituted for V hooks, variable and independent cut-off.*"

The writer knows the engines well as the "2-ones" (11) and the "Quickstep," and thinks they had very large drivers in Mr. Kingsland's time, carried 110 pounds pressure, also that 115 pounds was *very high pressure* in those days. Years ago old St. Paul men concurred with Mr. Kingsland in his statement as to their economy and smart ways.

With such a valve motion, the *exhaust opening* and *closure* remain constant, and can be so arranged as not to let go of the steam at half stroke, but carry pressure on the pistons to a point where it ceases to exert much power on the crank. Does this not do away with excessive compression? And I might add, an engine running fast needs pressure to overcome the momentum of heavy and fast running piston. Shall we produce this with compression or with live steam?

Early closure of exhaust is probably bad policy, but going too far the other way causes the clearance space and ports to be filled with live steam from the boiler. This does not tend towards economy.

The writer fired an old "Dicky Norris" hook-motion engine, boot-heel fire-box and independent cut-off. Occasionally the driver would lay off a trip, and every one who run her in his stead coming from a link motion engine always told the same story—"a little the smartest they ever handled."

The Stevenson balanced valve, invented by W. Stevenson, Findlay, Ohio, carries a cut-off valve on top of main valve, all balanced in a novel manner. But to hint of this being used on a locomotive causes a howl to go up, and we are asked, What are you going to do in case of derangement on the road? This reminds the writer of the remark a French "locomotive expert" made to Joshua Rose in Paris, lately, while they were commenting on the position of valves on the French locomotives—beneath the cylinders and parallel with the track, so that they can be got at only when engine is over a pit: "*When we put the valves in, we put them in right and attend to lubrication properly, and if you in England or America have to arrange to get at valves when in service, there is something wrong with your practice or construction.*"

Will Mr. Kingsland tell us how many eccentrics the "old Lawrence" engines 11 and 12 had, and how they were arranged? W. U. JUNCTION.

Western Union Junction, Wis.

On Indicator Rigs.

Editor The Locomotive Engineer.

In your July issue Jos. E. Howell suggests an improvement in my indicator rigging (illustrated in May issue), regarding extension of reach rod to chest cover. Mr. Howell would extend wooden rod and make marks on its left side, so that the left-hand operator could also note position of lever. This arrangement might work well on engines with short arches, but an objection is that it would be in the way of the right-hand operator, where the room is so limited; and to make the improvement on the engine illustrated, the rod would have to be carried beyond the extension front, and it would then be necessary for the left-hand man to make too many moves to obtain his data when cards were taken as frequently as once a minute, often necessary where a full test is being conducted.

There is no question that the idea could be so arranged that the left-hand man might note the position of the lever, but it is not necessary where two operators are working together, and diagrams are taken from each side at the same instant. Any error of observation would be detected on the card itself if there was doubt, so that a check is not necessary.

In regard to the rigging as a whole, I will say that, after some considerable locomotive indicating, I find the method illustrated to be the most satisfactory I have used. All the data wanted can be taken quickly, and one has the satisfaction of knowing that he has seen everything connected with the test himself, and has personal knowledge of any incident that may have come up out of the general run of the test.

H. G. MANNING.

Watertown, N. Y.

Spotters.

Editor The Locomotive Engineer.

Once in a great while—a very great while—a spotter does some good—one of 'em fell off a train out West not long ago and was killed.

There's more than one breed of spotters—the man who "has the ear" of the division officers and always has a story to tell—in confidence—is the worst kind of a spotter.

I came within a car length of being a spotter myself once. It was a kind of a partnership spot between another plug-puller and me, and if you'll hold still a minute or two I'll tell you about it.

If your memory dates back to the year after the Centennial you will remember that there were several strikes and a whole heap of grief in that 101th year of the American eagle.

I thought the road I was on couldn't get the night express over the road without me, and the first job I got after they did get it over was six months afterward, and was a grub-stake job drying sand on a far Western road. My partner, Joe Johnson, got a job piling lumber in the yard—both of us had a promise of the first engine in sight.

One day the M. M. sent for us both, and we were in high feather—expecting to go running.

We met the M. M. and the Div. Superintendent, and they sprung two propositions on us.

One of us was to become a "body-snatcher"—go to every engine in the yard 30 minutes before leaving time, and if the man was not there get her ready, go out on the engine, and send the man to the office for his time. I took that job, got several engines ready, but I never went on any—I kept a private caller.

Joe was wanted as a "breath smeller." Management was satisfied that many of the *employes* were in the habit of going on duty drunk; they wanted to get rid of the guilty ones, and observing that we were both sober men, would one of us take the job?

Joe and I went out in the hall, held a council of war, and Joe decided to take it at $3 per day, and make his report monthly.

It did not look much like a job running for either of us, but there was a month's time at full pay ahead, and that was a good deal to us then.

Body-snatching occupied little of my time, so that I busied myself helping Joe. We had a pretty particular set of officers, and we were very particular with Joe's first month's report. Here it is *verbatim*, from an old copy that I keep as a memento:

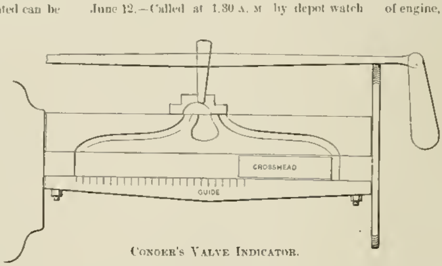
To the General Manager of the X. X. & Y. Ry.

Sir:—Your committee of one sent to investigate the report that there was much intemperance in the service, beg leave to report as follows:

June 2d, 11:30 P. M.—Saw two men carrying a case of bottled beer through yard; supposed it was going to some engine; followed them; took beer to a car on track 4, curtains all down; heard singing and boisterous talking; got on brake-wheel and looked in ventilator; saw John Doe, Supt. 1st division, T. Tool, general roadmaster, and two females—females were sitting on men's laps—all singing and drinking; called John Alexander, Ike Wilson, engineer of the 142, and Mr. William Cole, Justice of Peace, who was passing, to see, and to whom I refer you for evidence; was interrupted by special pulling out on tour of inspection. No doubt Mr Doe had drunk too much for the good of the service, but I would recommend him to mercy on account of his family - a man over 50 years of age must love his wife when he will hold her on his lap, and sing to her till midnight.

June 5.—Conductor John Smith paralyzed drunk in the yard—refer to any yard man on duty on that date. was making his brags that he was all right, and stood in with you; said he was your son-in-law.

June 12.—Called at 1.30 A. M. by depot watchman to see a drunken engineer going out on 28, went to engine, found the fireman oiling around, and engineer lying on ground asleep; fireman said the engineer had only been in 1 hour and 25 minutes, and had doubled the division four times without rest, 53 hours; fireman was an extra, and had only been out one double with him—recommend a 10 days' lay-off for this man *on full pay*, and 30 days' lay-off for officer responsible for this long time on duty.



CONGER'S VALVE INDICATOR.

June 21.—Directors' meeting, all drank heavily; seven baskets of champagne used at lunch alone; President Robins very conspicuous—breath smelled badly.

June 24.—Mr. Doe's car back in yard—he is not sober yet.

June 27.—N. Merritt, chief dispatcher, son-in-law of president, sick at Grand Central hotel, was very drunk night before; slept on billiard table—think a dispatcher who was not related to president would do better.

These are all the cases that have come to my notice, except information about amount of liquors carried to your house weekly—don't suppose I can give you inside figures on this, not already known to you. Respectfully submitted,

JOE JOHNSON, Inspector.

Of course, Joe and I expected to "take to the road" for this, but we did not. We both got engines, and our officers stopped the report from going beyond the superintendent's office, and then treated it as a joke, charging Joe's time up to construction.

In delivering the report Joe excused himself, and said if the report was found defective it was because he had mistaken just *who* were to be considered "employes."

Did you ever see a temperance notice signed by an official that was a teetotaler himself?

Did you ever see one that counted any one as an employe who had an initial behind his name?

Did you ever see a shop where the sign, "No Smoking" was conspicuous, where every petty officer that came along did not inspect it with a cigar in his mouth?

Did you ever see an official who refused to take his check out of the pay car—just the same as an "employe"?

If all spotters will follow Joe's lead, and get *proof* of every case reported, consider all men who draw pay as employes, and report all, regardless of position, the enginemen of the country will welcome them into the service, and if all are treated alike there will be need of a new crop of officials before there is of road men.

JOHN ALEXANDER.

A Wooden Indicator.

Editor The Locomotive Engineer:

Take a piece of two-inch plank, 3 or 4 inches wide, cut it just long enough to go on top of the outside guide and between the back head and the guide yoke. Take off the guide cup if it is in your way. Nail on the edge of the 2-inch strip a thin piece to come down along the edge of the guide, just wide enough to come down to the top edge of the cross-head. Mark on this thin piece a plan of the ports, exact size of the engine it is tried on, and extend the ports down to the clearance at the end of the cross-head which will represent the clearance at the end of the cylinder. Mark the bottom guide off in inches, from the point of travel of the cross-head. Make a wooden valve same length as valve of engine, and mark on the edge of valve and exhaust port, exact size. Fasten a strip on the back edge of wooden valve seat, to let the valve slide against. This valve is connected with the valve rod above by a clamp, which will move the wooden valve just exactly as the valve inside the steam chest is moved. To set it, move the engine over till the steam begins to come through the port and out of the back cylinder cock, set the back edge of the wooden valve for that position. Then move the engine ahead, see if the front edge of the valve is right, get both steam openings the same as main valve. This "indicator" will show the exact position of the valve at any portion of the stroke, whether the link is hooked up or at full stroke, and if the lap or lead is not proper for the work to be performed it can be intelligently altered. One thing will surprise most of the engineers who have never seen it tried, and that is the point in the stroke of the piston where the valve commences to admit live steam when the lever is "cut back" near the center notch in the quadrant. Try it, boys, it is cheaper than the steam pressure indicator or motion curve machine, and it shows just exactly what is going on in the steam chest.

CLINTON B. CONGER.

Lansing, Mich.

The Shovel and the Mouth.

Editor The Locomotive Engineer:

Your article in June issue on the difference between the mouth and a shovel for firing should be read and pondered on by many master mechanics who now employ officers who do "firing with their mouth," and mislead those who have to do it with a shovel; if the master mechanics mentioned would do so, and take the hint it conveys, it would not only be to the advantage of the company which employs them, but would save suffering to many an engineman who listens to and follows the teaching of the fiend "who fires with his mouth" from a soft cushion or the shady side of a roundhouse in warm weather.

If the fiend is an official, and we find he generally is, and it was worth while to look into his past, we would find that he commenced his official career through the influence of that mouth and the weakness of an official. He imagined, and does so still, that his appointment was made on account of the size of his head, and from that time assumed a fatherly manner to those under him, and a brotherly one to those over him. The first he tries to impress with the idea that he is advocating their cause with those above them, and his superiors that he is the one that keeps the men contented by his influence with them. The fiend is cunning in small things—catches straws that indicate that men are to be promoted, and about what time, and then recommends them for promotion, and tells the man that he thinks there is going to be an opportunity for some one, and he will see what he can do for him.

This mouth man is *ex-officio* a member of the stove committee, and it is at the frequent meetings of that committee that he gets in his fine work—work that is not only injurious to the company that employs him, but also to the young man who listens to it. And it is usually young men who listen, and at that time of life when it does them the most harm, by weakening their faith after trial, in work that, if properly taught, would have been to their advantage.

In time they resign from the committee, call him and all teachers cranks, and their places are filled by other young men who hope to gain his influence, and to do so refer to the puzzles that come up daily in their work, and in engine houses, and he solves them all to his own satisfaction. He is an expert on coal, and wants to be appointed coal inspector. Has made lubricating and other oils a study. Valves and valve motions have been the subject of his sleeping and waking dreams. He says the present type of locomotives is antiquated, and that the coming one will use but one pound of coal per horse-power (he is above expressing the consumption per mile). Says that the Hudson Bay & Cape Horn road is putting the Cotton fire-box on all its locomotives on the Hudson Bay divisions, on account of the cost of coal and the cheapness of ice along that division. He is a strong advocate of a valve motion gotten up by a friend of his (and every man who brings out a device is a friend) in Alaska, that takes its motion from the tender truck, and thinks his road should adopt Simpleton's driving wheels. Adds that a hollow axle with a stream of water through it would keep it cool, and that the waste water would keep down the dust and increase the comfort of traveling. Claims that one pair has the adhesion of two of the ordinary driving wheels, and that the recognized law governing friction is wrong. He tells of the wonderful performance of the Wenk locomotive—that it can run four hundred miles with an average of but one stop of ten minutes in every forty miles, and when asked if its fire, or the fire on any locomotive cannot be cleaned on long down grades, says that some can and others cannot.

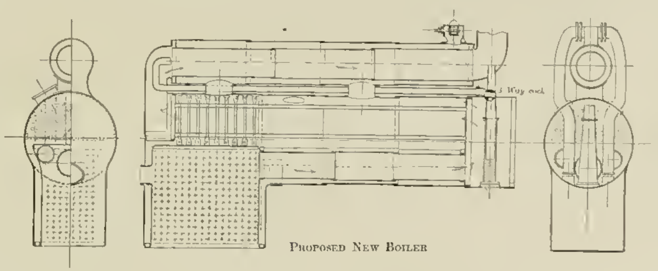
But when you come to firing he is at home. He is the man who invented firing—first proposed the use of coal as fuel, and introduced the use of a shovel as a tool for firing in place of a basket, on the X. Y & Z. road. He was sent for by the president of G. O. S. & O. road, and asked to investigate the cause of the locomotives using so much coal. He was put on as a hostler, and the Supt. and M. M. instructed to adopt any suggestions Mr. Gab might make. He told the president that the cause was that the switch lights were too small and lighted too early. But the Supt. and M. M. were old fogies, and Mr. Gab found he could do nothing and quit, and the M. M. then discharged his cousins and his aunts.

In time the experience of Mr. Gab comes to be a joke with the older men, and serves to pass the time in corner dwellings where schooners are sold and cargoes of free lunch are stored; but the young disciple listens to the words of wisdom that Mr. Gab lets fall, one of whom asks him why it is he cannot get his engine to steam, and is told by Mr. Gab that, when he was a fireman, if a man could not get steam that he was fired; that when he was on the Sandy Hook & Barnegat road, in 1821, that he was told to go and fire an old Hinckley that ran the Heron express, and that had had seven firemen in three days. He told the engineer that he was going to make that engine steam, if he had to burn the cab. "The engineer smoked a clay pipe and plug tobacco, and spit on every tenth cross-tie, and told him he had better do it," and he done it. The old man sent for him and told him that that was the first time in two days that the engine had made time. Then Mr. Gab tells the fireman that he burns too much coal, and that if he knew his business that he could get plenty of steam. That he should study the theory of combustion, and be a credit to his craft. That he intends to recommend to the old man to open a school for instruction, and that he will volunteer to be the instructor, for it is shameful the way the firemen on that road fire, and that they are wasting 25 per cent. of the coal used. The unfortunate fireman thinks that he has done wrong, and that if he asks any more questions that he will expose it and get ten days, and then goes off and Mr. Gab also—to look for the man who is to bring him down some eggs.

Now is it a wonder that fuel is wasted through improper firing under such instruction, and unfortunately it is about the only kind of instruction that many roads can give, or do give to young firemen, and at a time when they are anxious to learn, and if properly taught in the elementary principle of the work they have to do would follow it up, and advance in knowledge that would be advantageous to the company as well as to the men. Time and money are expended in locomotive designing to produce economy of fuel on all roads, yet on but few roads are any intelligent instructions given to the man who is the most important factor in the problem. A road foreman may be employed who has the knowledge and ability to teach, and may try to do so and succeed with a few, but his knowledge is looked upon as personal and not as the road's, and in using it he is apt to meet with indifference from those who will say that it is his theory only, and there are so many men that he has not the time to demonstrate to all that his story is correct. In the meantime Mr. Gab has been "firing with his mouth," and giving lectures on the admission of air above the fire, and the relative value of heavy and light fires. The fireman tries the first at wrong place and time, and the second on a locomotive without regard to its construction or work, and with, perhaps, destruction to himself. But let a road or its officers know the theory of combustion, lay it before its young firemen in a simple elementary form, and appoint a man who has faith in it to teach its application to the firemen in a practical manner, and not only will there be less talk of waste of fuel by that generation of firemen, but a producing of engineers from them that will prevent it in the future, and the occupation of the "man who fires with his mouth" be gone, and a more useful one can be found for him in cleaning windows to let in light on more useful workers.

A VICTIM

New York City.



PROPOSED NEW BOILER

Proposed New Boiler.

Editor The Locomotive Engineer:

A great deal has been done and said in regard to straight stacks, extension smoke-boxes, and single nozzles. What the results have been no person is prepared to give a decided answer. My opinion is that the advantage yet attained does not pay for the extra expense that is attached to them.

What is wanted is boilers built large enough to allow of steam being made without having such a strong blast as is usually used; for if you have got to have the strong blast on the fire, sparks which are not properly burned will be lifted out of fire and drawn into front end, and when there they have got to be got rid of, often at the expense of big fires, which cost R. R. companies lots of money.

There is one thing certain, that boilers have not been enlarged to correspond with the difference in size of the cylinders and the extra work engines have been made to do of late years. I send you a blue print of a boiler patented by Mr. Sharkey, boiler inspector of the western division of the C. P. R., which he claims will do away with leaky flues and foaming in alkali water, and with a saving of fifty per cent. in fuel.

His fire-box is connected with three large flues which run through the boiler to front end, and smoke passes through these and then back again over top of fire-box by small flues, and from there out of chimney which runs on top of boiler through steam drum, as shown in blue print, which has a 3½ or 4 inch steam space all round and full length of boiler, and is connected to boiler by two columns, which allow steam to pass from main boiler. You will see that by the time that cinders, if there are any, get to the stack, they will be dead and that smoke and gases are used for heating purposes until they are of no more use. The throttle is placed on top of steam drum and just behind stack, which is a long way from water level, and this is where Mr. Sharkey claims an advantage in alkali water.

In addition to the above benefits he claims his boiler will make ample steam to heat passenger trains with, he fears no trouble with regard to making steam, as he has so much extra heating surface, and another benefit is his mud ring, which is made and flanged out of solid plate and is the same material as boiler; this does away with unequal expansion. You will see by blue print that exhaust pipe runs into chimney, which makes the draft on fire very light, and if this is found to be not sufficient there is a three-way cock arranged in exhaust pipe so that exhaust can be run through independent pipe between steam drum and boiler and used at back end of chimney.

I have been reading John Alexander on schemes and schemers, and his warning. I would like very much to see him writing in our *B. of L. E. Journal*, as his ideas are the same as mine, and I think the majority of fair-minded men are of the same opinion.

Winnipeg, Manitoba. SUBSCRIBER.

Smith's triple expansion exhaust pipe seems to be quietly proving that it is right in principle. It is now in successful use on the Bell's Gap, Mo., Pacific, Boston & Maine, Old Colony, Kan. City, Ft. Scott & Memphis, the Wabash Western, and several other lines. In every instance where we have heard from it, it is reported as running successfully with an opening equal, if not larger than the ports, the engines steaming well and throwing little fire. More than this can hardly be asked.

The trouble between the U. P. and the engineers is all settled, and that in the very best way—by arbitration. The pay was restored to the old figure, with all back since the reduction.

In Mr. Kenyon's rule for setting slipped eccentric in last issue, 8th line from top should read "forward of axle *not* enough," instead of enough.

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DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS.

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CONTENTS

The Annual Present Fraud.

Last month we offered a little advice to, and mildly remonstrated with the rank and file of railroad men for imposing upon people, and now we want to belabor them again for being imposed upon.

How many of you pay out from $1 to $10 per year for presents to some one—generally far better able to buy presents than you are? A good many, we will warrant. How many gold watches, silver sets, etc., have your superintendents, master mechanics and other officers got at your hands? How many have you got at theirs?

When an official leaves the service who has been a particularly fair and just man in his dealings with the men under his orders, we have no objection to seeing him receive some substantial reminder of the esteem the men have for his management; but the idea of making Christmas, or any other presents to officers in the service, should be frowned down by the men and killed entirely by the officials themselves.

There are not only too many men willing to start such lists, but there are altogether too many foremen and master mechanics about our shops that encourage and aid in such work. The next time there is a list stuck under your nose, asking you to contribute to the purchase of a watch or a diamond stud for some official who gets about four times as much pay as you do, just say to the *lister* that you don't believe in "standing in" in that way, and won't give a cent; and when a list is passed for some unfortunate co-employe or his family, don't plead poverty, but invest your present-money in charity—it will return to you after many days—the present never will. This present business goes to extremes sometimes, we recently dropped into a roundhouse with an engineer just getting in off a night run, and the night foreman flushed a list on him—it was to purchase a suit of clothes for a certain minister in the village and was headed by the master mechanic for $5, and the foreman for $1—this was to bait the men.

Our engineer read the foreman a lecture, said that the M. M. was the only employe of the company who belonged to that particular church, and told him to tell the M. M. in the morning, that if the list was passed among the men he should go to the general manager about it. This engineer had considerable moral courage, and told us afterward that he intended to break up that present business, the pay car seldom passing without a case coming up—he called it "the invisible blackmail."

Subscription lists for charity are noble monuments of man's humanity. Subscription lists for presents for officials in office are humiliating evidences of man's degradation and weakness.

Put your shoulder behind the one, and your foot upon the other.

Cab Doors.

No one knows exactly why locomotive cabs are built with inward opening front doors. Some don't think about it because they never saw them hung any other way, and most of the enginemen of the country grin and bear the inconvenience, satisfying themselves that it is part of the business—a disagreeable part.

When the doors are swung from the outside corner of the cab "in," the door on either side, when partially opened to admit air, makes a deflector to shoot all the air, smoke and cinders—especially cinders—across the cab and into the face of the man who does not want air—or cinders either.

Many a fireman, wringing with sweat, is riding over the country cooped up in a cab that might be kept cool if it was not for the deflector that would blind the engineer.

Front doors that open outward from the side next boiler are not in the way of anything in the cab, do not become deflectors of dirt, and can be opened any desired amount, and the air will go directly back through cab for the benefit of the man who wants it, and without annoying the man who does not want it. The door then becomes a deflector to catch and deposit cinders outside the cab instead of inside, and, while the outside opening door delivers air, and dirt, in direct proportion to the opening, the inside opening arrangement delivers air in direct proportion to the opening, but all the cinders that strike the door.

Some builders go so far as to put a small door in the lower panel of the door, so that men can get air without so much dirt.

It is cruel to prevent a half-suffocated fireman from opening his front door for a little air because the engineer is cool enough.

Long Hours.

We have been requested repeatedly to ask for and publish letters from railroad men all over the country as to the number of hours worked by men in the motive power service. We have not done so, because we know that most roads, or rather the management, object to the publication of such facts as would point out their roads as running locomotives with men who have been on duty 40 or 50 hours, and would take revenge on the men for so doing.

There is little doubt—in fact, no doubt—that a man on duty, running or firing a locomotive for more than 12 hours without rest, is too tired and worn to use all his faculties at their best, and many a fearful accident has been caused by such arrangements; but where men are paid by the mile it is as often the fault of the men as of the management, and before indiscriminate blame is attached it would be well to look to the real cause. An average of 60 to 70 hours per week is enough service for any engineman, and they should get full pay for that. It is next to impossible to avoid extra work and extra hours in "rushes," but for a steady thing they are elements of danger.

On every division where there is a chance to make extra time by "sticking to the engine," there will always be found a hog or so who wants to make 27 hours a day, and sleep down hill. We have no objection to the time hogger, but have to the average superintendent who gauges every other man's powers of endurance by the hogs.

Signals and Engineers.

The unsatisfactory and slipshod state of discipline in the train service department of the average American road was well illustrated this week in the long delays to passenger trains at the Jersey City terminus of the Central of New Jersey, on the day the new interlocking was first used there. Passengers by the hundred got out and walked a mile or so to reach the ferry. The signals are simple and admirably arranged, and the explanatory circular had been duly issued to the engineers, but they had not thoroughly studied it, and consequently nearly all of them were so slow and cautious that they hindered each other greatly. Those who were not cautious ran past signals with the temerity of a baby playing with a pistol, though, with the usual good luck, few switches were torn open. The simple trouble was, of course, that no one had seen that the engineers *understood* their circulars. Probably they signed the usual receipt reading, "Order No. — received and understood." It would seem to be about time that intelligent superintendents take measures to explode this farce. An employe signing a statement which he does not fully mean or fully believe, is encouraged to other breaches of discipline. It is, to be sure, not a specially easy task for an old engineer to study a complicated system of interlocking for the first time, but there should be a great improvement over the present state of things on most roads.

The above wholesale charge of lack of discipline of the engineers employed on a large passenger-carrying road is from the *Railroad Gazette*, and is so manifestly unjust on its face that we investigated a little.

The signals and interlocking switches mentioned were put up by a reliable firm; the engineers were amply instructed in their use, and an attempt made to use them before the apparatus was complete, the men who were to handle it properly posted, and where the plan of the time card made it impossible to handle the trains over the tracks

The Central Railroad of N. J. runs something over 280 passenger trains out of and into the Jersey City depot daily. The depot shed is open only at one end, and has fifteen tracks from which all these trains arrive and depart. They go in on one side and leave from the other. In order to switch the trains from one side to the other a track was laid from the center each way *across* and leading into these tracks, and the plan was to have each locomotive that came in to kick her train back down this track to a regular switching track known as "track 10," the engine to follow out and go to the house by another track.

At the signal tower all the tracks come down to and enter the main line tracks, six in number, and the tracks from the *in* side *crossed* the outgoing ones.

Every train that went out or came in blocked every other train going in either direction.

As the interlocking system calls for the movement of several levers for each train, and many of the trains are timed to leave at the same time—five or six at a time in busy time of day, it was simply impossible to handle them during the busy hours.

The company tried to use the system for a couple of days, but gave it up and replaced the hand levers. Instead of the engineers "running past signals with the temerity of a baby," the engineers were the only men who kept cool, one man showing his good sense and cool head by refusing to run his engine past a signal and over a misplaced switch on the positive order of a badly rattled general superintendent who was getting desperate.

If all the engineers of this road are fools or ignoramuses, we fail to note the signs among a large acquaintance there. If the failure was due to improperly instructed men, it seems to us as if it would be cheaper to instruct them than to remodel and change the tracks and switches, as is being done.

No investment will pay a road better than a careful, complete and intelligent analysis of the water used for locomotive boilers. When the peculiarities of the water in each tank are known, excessive use of bad waters may be avoided by the engineers, if it does not pay the company to change the source of supply or the location of the tank itself. Several instances have come to our notice where most of the water stations on a road were moved or abandoned within the first five years of the road's operation—generally to secure better water or to get a self-filling or "gravity tank." Young engineers of tests can make themselves a reputation, and make it pay the company far better, by going into the analysis of the feed water, than in wasting the grey matter of their brains upon comparative tests of the link as against the general master mechanic's patent radial gear, or anybody's traction increaser. By the way, engineer of tests seems to be a regular office in our motive power force now-a-days, and there is little doubt that the engineer of tests has come to stay—let him tackle the feed-water problem—there is millions in it—millions of tons of mud and scale.

On June 29 a passenger train on the N. Y., N. H. & H. road was thrown down an embankment by a poorly spiked frog or rail, the section men, working without a flag, had been replacing old rails with new. There was a clear track for two miles, and they could see the approach of the train in time to spike the rails sufficient for safety, but appeared to think two spikes in a frog were enough. As a rule trackmen are paid the lowest living wages, and selected without regard to ability or intelligence. The foremen are generally selected from the best of the men, but the ability of a foreman to drive his men is oftener the cause of his promotion than his knowledge of the business of keeping up track. The section foreman whose ignorance or carelessness caused this wreck deserves to be under arrest, as he is, but the roadmaster over him is as guilty, yet he has to keep his track up inside of a certain fixed outlay of money, and no doubt employs the best men he can for the money.

Books Received.

THE CRANK: Its Motion and True Value for Transmission of Power in Practical Engineering. By F. Lenggenhager, Ph.D., Late Engineer to the Maritime Stations of the Austrian Empire. D. Van Nostrand Company, 23 Murray and 27 Warren Streets, New York. Price $1.50.

This author is no doubt a crank, and, therefore, ought to be able to write well on the crank subject—yet he fails to do it.

We do not remember of ever having seen a worse garbled-up mess in book form.

The author tries to prove all the way through the book that a very large per cent. of the power developed in the cylinder of a steam engine is lost at the crank, and goes into figures and tables and formulæ to prove his position.

To a mechanic the book has no value whatever, except as a curiosity. It seems to have been published in the interest of the Pitt engine, which contains a complicated device to take the place of the crank.

ASKED & ANSWERED.

(30) S. A., Talmage, Neb., writes:

Please give a list of books suitable for enginemen; not only about the locomotive, but general. *A.*—Write for a catalogue to the publishers of mechanical books who advertise in this paper.

(31) E. R. F., Waverley, N. Y., writes:

Will you please tell me in the August number of THE LOCOMOTIVE ENGINEER where I can get a paper showing and naming each piece of machinery on a Rogers locomotive? Please state price. *A.* The names of parts on a Rogers locomotive are the same as on any other. We know of no paper or book giving the names of every piece. Perhaps Alexander's Ready Reference or Forney's Catechism will come as near to it as anything in print.

(32) C. L. Dennis, Belsena Mills, Pa., asks:

(1) Where can the tallowed hemp piston packing be bought used by the P. R. R. Co.? (2) What will prevent white, hard scale in locomotive boiler? *A.*—1. We do not know who keeps tallowed hemp. 2. Depends upon what causes scale, white, hard scale is usually caused by a deposit of lime, and has been in a measure prevented by the use of crude oil. We do not believe that a boiler scale mover can be produced that will act the same in all cases, any more than a suit of clothes can be made to fit all people. The intelligent way to treat scale is to begin with an analysis of the water, and then designing a preventer or remover to fit the particular case.

(33) C. S. C., Watertown, Wis., writes:

On page 3, July issue, your paper states that "The E. T. V. & G. are running a six-inch nozzle in their consolidations", on page 5 you also say that the Strong engine on the Erie has her nozzles bushed to 3⅜. Their diameters compare as follows: 36 inches to 11 39-100 inches. What is the difference in back pressure on pistons? or what would be the increase of back pressure in cylinders on the "consolidations," if 3⅜ nozzles were substituted for the 6-inch nozzles? *A.*—The only way to accurately tell this would be to apply an indicator and test the difference that way.

(34) Frank Parker, Sanborn, Iowa, writes:

Will you please explain why, in turning a pump plunger ¼ eccentric, you set your centers over 1-16", where, if you had an offset of ⅛" before turning, you would set your centers ⅛" to turn both ends true. Where and what is the difference? If you will kindly answer this through your questions and answers, you will oblige several of the boys. *A.*—As we understand your question, you refer to the necessity of changing the center punch marks in the ends of the plunger in order to turn an offset to fit the lug in crosshead, when it is not in line with center of pump. If you wished to do this you would have to set its centers over the full ¼ of an inch. If you wish to turn both ends true, it is necessary to change the centers back to the center line of the rod, because they have been left out of center in turning the offset.

(35) Ignoramus, Raton, New Mexico, asks:

What is the cause of holes wearing oblong in back flue sheet? Is it caused by rolling or by the heat, as the front sheet does not wear so bad but they all wear the one way. *A.*—This trouble is often complained of, and if any of our readers know anything of the subject we would be glad to hear from them. That the holes in fire-box tube sheet should get out of round more than the front seems probable, and may be for two reasons. One is that they are calked very much more at that end, and another that when the crown bars are placed fore and aft, as they are in many cases, the front end of bar rests on the back flue sheet and the sling stays are not properly put in, the pressure on the crown sheet has a tendency to squeeze the flue sheet down and make the holes oblong.

(36) M. H. W., Dickinson, D. T., writes:

1. Has there ever been an extension front used with short nozzle and petticoat pipe? If so, how did it act? 2. Do you think that an engine with extension front would steam better if the top of diaphragm was farther away from flue sheet of boiler, as is the case in O. I. & W. front end shown in July issue of your paper? In most front ends the top of diaphragm starts from just above top row of flues and runs down so that there is very little space between end of flue and diaphragm; would it not be better if there was more space? 3. What would be your opinion of a front end with diaphragm and dead plate as used on O., I. & W., but with an upright plate about five or six inches from flues and with a space between edge of plate and smoke arch, and so arranged that the draft could be regulated by raising and lowering plate something as is done by petticoat pipe? 4. I am firing an 18x24 Baldwin "hog," with extension front. This particular front has a tendency to fill up at the bottom, back of nozzle, so that bottom row of flues is choked—what causes this and how can it be remedied? *A.*—1. Yes, and it did nearly as well as the short arch. 2. You do not give enough *data* for one to have an idea of how your diaphragm is located. Diaphragms have been placed in about all the different positions possible to conceive, and do well in many of them, conditions have much to do with it. 3. No good, any arrangement that is capable of being monkeyed with will not stay a success. 4. When the diaphragm is in proper place there will not be anything between flues and exhaust pipe to cause or allow cinders to accumulate.

The London & Northwestern Railway Company, the most important and perfectly organized road in Great Britain, has just issued a new regulation, whereby every person in the employ of the company, from the general manager down to the very humblest greaser, is entitled to an annual holiday of eight days on full pay. The other English companies are about to follow suit. Would it not be well if the great railroad corporations here, which profess to earn so much larger profits than the English railways, were to follow this excellent example set by the old world, and remove the muzzle occasionally from the ox that treadeth the corn?—*Daily Paper.*

We tried to say *two* several times in the proof, but the printers still made us say that the Webb had but *one* exhaust to a revolution—at last accounts she had two.

Air-Brake Practice.

FIFTEENTH PAPER.

By J. E. PHELAN.

We propose to make this our final paper on "Air-Brake Practice," as published in THE LOCOMOTIVE ENGINEER, for period commencing early in 1888, and ending with current number.

We do not stop now because the subject is exhausted, for there are vital points about "Air Brake Practice" not yet treated fully here.

The Westinghouse automatic brake is destined to fill a most extensive field in the future commerce of the world, and any man who imagines himself a graduate in knowledge pertaining to the Westinghouse automatic air brake, by going along quietly for a few years with ears and eyes open, and mouth ready to ask pertinent questions, will early learn what an important study this may be, and how knowledge pertaining to same may be gained from year to year as progress continues.

We wish here to call attention to the importance of utilizing all available braking power at all times for needs of service.

Any observer on an engine under motion, where two engines attached to a train as double-header, without braking appliances on either engine in use, can always notice how difficult it seems to make a desirable stop, under conditions most favorable when the extra weight is not added in form of an extra engine.

Similar conditions may be noted where heavy sleeping cars or dining cars are in regular service. The braking force does not always seem to increase in proportion to weight of train, while harsh application of brakes often seems necessary where good results should come from light application of air to appliances.

In service, occasionally an engine will make a trip with one car, or a heavy engine make a trip with two coaches, and where braking power is exerted without using any braking power on engine, it becomes a tedious and uncertain matter at times, stopping without use of braking power on engine. The use of tender brakes is required in all well-regulated service, but the matter of utilizing the power in driver brakes remains a matter of doubt to many minds when relating to stops in ordinary service.

Those having experience know how uncertain the matter of stopping becomes when one or two cars are required to stop a heavy engine when running at high speed. On the other hand, with a good working driver brake and tender brake, such a train can be stopped with ease without using the brakes on train of one or two cars. This is simply a matter of controlling the greater weight by its own braking power, or the greater weight controlling the lesser. While to stop engine and one coach or two coaches with use of car brakes only, it requires the lesser weight and power to hold back the stronger force in motion. Imagine a cat overcome by a rat—of course, all that may be necessary is to get rats enough.

The matter of a heavy engine controlled by one or two car brakes presents an extreme view not common in practice, but will answer for illustration of the principle.

In practice the weight of the engine is overcome by train brakes where driver brakes are not used.

But does it not stand to reason that each brake has enough to do in controlling the weight in motion of car to which applied? At least, such circumstance is greatly to be desired, and when once in practice on an intelligent basis, will greatly simplify braking at all times, and give most effective work for lightest application of power.

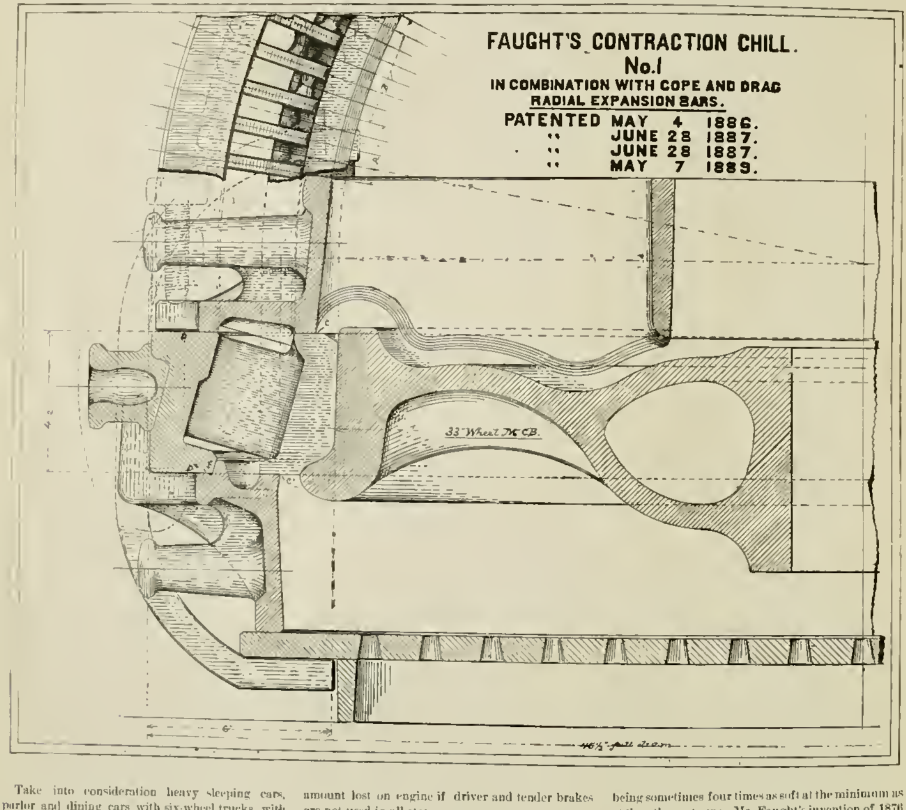
The demand on part of engineers in service for excessive air pressure can most reasonably be overcome by furnishing means for accomplishing desired results with moderate air pressure.

Take for example a modern ten-wheel passenger engine weighing 110,000 pounds, plus a loaded tender weighing about 70,000 pounds. Should this total weight, 180,000 pounds, in motion exert its own braking power, or should train brakes be taxed for the purpose in addition to exerting braking power for cars to which attached?

or 90 per cent. of the weight of the car at track under wheels to which brakes apply.

For example, take a car weighing 72,000 pounds, and having a total of twelve wheels. This gives 6,000 pounds resting on each wheel, or a total of 48,000 pounds resting on the eight wheels to which brake shoes ordinarily apply, hence, our braking power can be exerted on but 90 per cent. of 48,000 pounds, where, if brakes are applied to all twelve wheels, we should exert a braking power equal to 90 per cent. of 72,000 pounds, or total weight of car.

Say we have a train of six cars, composed of dining car, parlor and sleeping cars, and all averaging about 72,000 pounds each, with total of twelve wheels under each car, but with brakes applying only to eight wheels under each car. Under such conditions we absolutely lose one-third of the available braking power of the train, plus an equal



Take into consideration heavy sleeping cars, parlor and dining cars with six-wheel trucks, with brakes applied to but eight wheels under each car out of a total of twelve wheels under each car of this kind.

Usually, leverage is adjusted to apply a braking force on passenger cars equal to 90 per cent. of the weight of car *at track under wheels to which brakes are applied.* With a passenger car having four-wheel trucks, or a total of eight wheels under car, with brake shoes applying to all the wheels, we may exert a braking power equal to 90 per cent. of the total weight of the cars so equipped.

But with a car with six-wheel trucks, or a total of twelve wheels under the car, and brake shoes applying to but eight wheels out of a total of twelve, we cannot safely apply to the eight wheels a force equal to 90 per cent of total weight of such a car. In this particular, we can safely exert braking power equal only to 90 per cent. of weight of car resting on wheels, to which brake shoes apply,

amount lost on engine if driver and tender brakes are not used in all stops.

In other words, under such conditions, the matter is equivalent to running two ten-wheel passenger engines as double header on six cars, and requiring the six cars to do all the braking for such ponderous weight.

We are glad to know that a commencement has been made in applying brakes to all the wheels under heavy cars, and without going into this matter any further at the present time, we advocate brakes on engine tenders and driving wheels as well as on all wheels under all cars in train, and kept in condition for use, and for *daily* use in all stops—service or emergency.

Braking power cannot be made too effective.

All appliances in daily use, and properly cared for, can be relied on to much better advantage for emergency, than so-called emergency devices seemingly available for emergency, but generally out of order when needed most urgently.

Faught's Improvements in Contraction Chills.

Probably most of our readers are aware that some thirteen years ago there was invented in the city of Philadelphia, a car-wheel chill that became smaller on its inside diameter when it was subjected to heat, as in casting a car wheel. The object of this invention was to construct a chill that would remain in contact with the tread of the wheel, until the mass became solid. The old form of chill, a solid ring, produced chill enough, but the instant it became hot, it began to expand, and, as it was pinched by the clamps between the cope and drag, it would follow the line of least resistance, leave the wheel on one side, and remain in contact on the side having the tightest clamps, making not only an uneven chill, but a wheel out of the round. The hardness of the uneven chill varied more than its depth, being sometimes four times as soft at the minimum as at the other extreme. Mr. Faught's invention of 1876 consisted of an outer and an inner ring, connected by radial arms, the inner ring being divided between the arms, leaving each spoke or arm to support a section of this ring. When this chill was used, the heat expanded the sections of the inner ring and the arms, before it was communicated to the outer ring, the expansion carrying the inner ring towards the center, thus keeping the chill in contact with the wheel longer than by the old style. Although wheels so cast were a marked improvement, the chill was not perfect, as it had a tendency to get out of the round itself, with the heat and rough handling of the foundry, and, as the inner ring section was firmly clamped between the cope and drag, the movement of the sections was retarded and the chill expanded unevenly. Mr. Faught's first improvement consisted in tying the arms together, alternately at top and bottom, as shown at B, Fig. 1. This helped in a great measure to prevent uneven expansion, and kept the chill itself round.

In June, 1887, Mr. Faught patented a great improvement, which he calls "The suppression of the mould." This consists of clamping the *outer* ring between the cope and drag, enclosing the space between the arms in the mould, and leaving the inner ring of sections entirely free to move inwards, no clamping being done on them. The mould having a slotted chill is thus restored to the conditions that would exist in one with a solid ring chill; preventing the rush of air through the slots keeps the dust and dirt from being carried to the tread of the wheel, maintains the pressure desired to keep the mould from dropping, and preserves that quietness necessary to a good casting.

This arrangement is shown very plainly in both illustrations, the ring is free at C and C², but bars tends to force the chill toward the throat, and the heat has to go up the inclined bar and down the outer rim before it can expand it. This plan makes a perceptible difference in the length of time before the chill "lets go" of the wheel. These improvements have made the present radial bar chill much superior to the older devices, but Mr Faught did not rest satisfied with the perfection of the radial chill, but eclipsed all his former efforts in the invention of the secant bar chill, which he calls his

INCREASED CONTRACTION CHILL.

This chill is fully shown in Fig. 2, and the sections are arranged the same as in the radial chill, the cope and drag clamped to the outer ring, expansion bars entirely enclosed in the mould, and the isolation of the lower part of the outer ring from the heat.

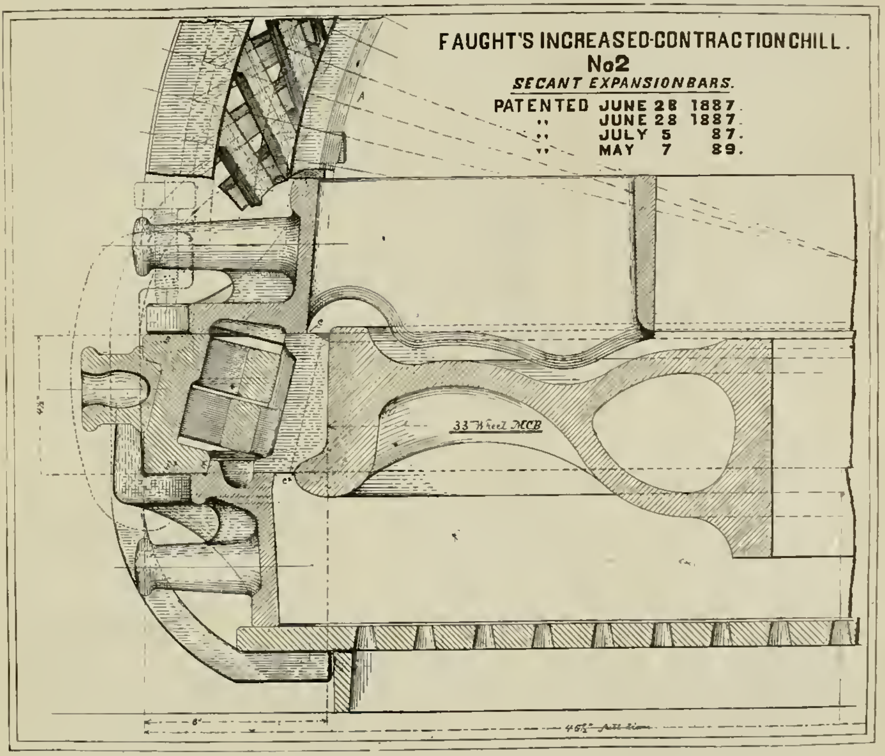
The improvement in the expansion bars is the simple application of a geometrical rule.

it strong, and prevents its getting out of round.

That wheels made in contracting chills are more evenly chilled, and more uniformly round, is now almost universally acknowledged in this country, many roads specifying wheels made in these chills for all cars put in service, and the problem has resolved itself down to a matter of perfecting, simplifying, and cheapening the chill.

We do not hesitate to say that the next generation of railroad men will look upon the inventions of L. R. Faught as one of the greatest improvements to rolling stock made in many years, as it will increase the safety, length of service, and strength, and decrease the cost of cast-iron wheels, making possible their use under the enormous loads we are now piling upon our cars.

Now that his chills are upon the markets of the world, we bespeak for him the recognition and remuneration that his research, industry and inventive ability deserve.



clamped firmly at D and D². The arrangement has also a tongue with a taper fit at E, that, in combination with the outer closing snugs on the drag, entirely obviates the uneven joining of the chill and mould, resulting in what is known as a "lapped" wheel.

Of course, the longer the radial bars, the more contraction is secured before the outer ring begins to get hot and carries the whole chill away from the wheel; but to get them very much larger than the wheel reduced the capacity of a foundry very much, so that economy of size was a feature not to be lost sight of. Mr Faught overcame some of this by the depression of the bars, so that the heat has to travel through more iron before it begins to expand the outer ring. The metal at the bottom of the chill begins to get hot first, as the first metal poured comes in contact with the lower part of chill, the expansion of the lower part of ring first caused the chill to "lift" slightly, thus taking the pressure off the throat of the wheel—just where it is wanted the most. The angle of the

The arrangement of these bars is plainly shown in the sectional view at A, in Fig. 2.

In Fig. 3 is shown one section of the inner ring with its secant bars, and it requires no mechanical

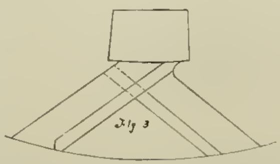


Fig 3

ability to see that the lengthening of these expansion bars would force the block as much farther than would the lengthening of a simple radial bar behind the block. The bars and blocks being conjoined or interlocked, like a girdered bridge, makes

On July 24th the steamship City of Rome started across the Atlantic with a delegation of American working men and women, known as the Scripps League Expedition, to inspect the usages and customs in the different branches of industry in Europe, and write up the differences for the columns of the different newspapers belonging to the league.

There were forty people representing as many trades, all under the charge of a manager and editor. The locomotive engineers are represented by Joseph Thorp, the oldest engineer on the Mobile & Ohio road, he learned the machinist trade before becoming an engineer, has run for 18 years, of late years as "special" engineer. Bro. Thorp is 38 years of age and a member of the B. L. E.

His comparison of European shops, locomotives and roads with our own ought to be interesting and instructive.

There is a great deal of comment and complaint among the patrons of the Central R. R. of New Jersey, about the way the Westinghouse air-brakes are handled, and there is good reason for most of the kicks, but the kickers do wrong to lay all the trouble to the engineers. We ride thirty miles daily on the road, and have taken particular notice of the brake service. It is almost impossible to find a train of cars made up where there is any evidence at all of careful adjustment of the levers under cars, some of the pistons go clear out, and then don't set the brake, others travel 8, 6 or 3 inches, according to circumstances.

It is impossible for an expert to do good work with air where this condition of things exists. All leverages should be so adjusted that the pistons will have nearly a uniform travel; then the pressure in brake cylinders will be approximately the same, the braking force the same, and release occur at the same time throughout the train. A few of the engineers do handle the brake as if they were leading a refractory young bull, and the traveling engineer should ride with them and do a little explaining.

We have been on several trains within the past few months, when the trains left terminal stations with disabled air-pumps. There is no excuse for this; on roads where they make a study of air-brake service extra pumps are on tap at every roundhouse, and a machinist and his helper will put a new pump in place of your old one in from ten to twenty minutes.

Wm. J. McCarthy, of Menominee, Mich., has got a patent on the idea of placing an iron house, or cage, over a switch stand, that can not be entered or escaped from except the switch is set for the main line. It does not make provision for a man leaving the switch open after his train has entered a siding and staying in the fort himself. We believe that the original idea was to so arrange the trap that if the switch was left wrong the man inside would be killed—not so bad an idea after all. Now if this inventor will perfect a device that will cage the flagman who don't flag, or kill him if he don't get back a reasonable distance, he will be doing mankind a service.

F. C. Robinson, a friend and correspondent of this paper, formerly general foreman of the Wabash shops at Danville, Ill., and now master mechanic of the Atlantic & Danville road, was in this city the latter part of July, selecting tools for his new shops, now building at Portsmouth, Va.

About the time this paper was started, Bro. Robinson was running a locomotive, but once given a chance to show what was in him, he forged to the fore; he was a missionary for THE LOCOMOTIVE ENGINEER on the Wabash, and has already sent in a batch of converts from his new field.

The past month has been crowded full of fatal accidents, the most of which are attributed to broken wheels or defects in the track. Better wheels must be used under our heavy rolling stock. A six-dollar cast wheel becomes a powder magazine under a 60,000 pound car running at 30 miles per hour. Just how carefully the details of track kept up by men working from 12 to 14 hours per day for about one dollar, is not known, but railroad managements seem to do little if any figuring on this subject.

The neat little rig shown on another page to indicate the location of the valve was put upon a locomotive several years ago by Clinton B. Conger, to enable him to study valve motion. He says the boys all laughed at him, but he learned considerable by its use just the same. Except in case of broken stem of valve yoke, it will prevent a man hunting on the wrong side if something is wrong.

John W. Cloud, Secretary M. C. B. Association, announces that the revised rules of interchange of cars are now ready for delivery. Goes into effect September 1st. Prices: 25 copies, $1.00, 50 copies, $1.75; 100 copies, $3.00, to which will be added the cost of postage when sent by mail.

Many engineers predict that the Denver Convention, in October, will be the longest session ever held.

The president of this company was slightly jumbled up in the wreck on the New Haven road on June 29. He says he don't object to playing hide and seek on his car among a lot of cast-iron chairs if it is going to do anybody any good, but when forced to so perform because of some one's carelessness, does not enjoy it.

Probably no improvement of the locomotive made in the past 20 years—unless it is the injector—has met with such success as balanced valves. Almost everywhere we go we find them in general use or being tried.

What is the matter with "vestibuling" between the engine and tank, in districts where the blaze in the headlight freezes stiff from November till April?

The new freight engines for the Montana Northern, a division of the U. P., are consolidations, 22x28, with a 72-inch boiler, designed by Mr. Cushing.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. IX. NEW YORK, SEPTEMBER 1889. 1.00 per Year, or 10c. a copy.

Historical Locomotives

TENTH SKETCH.

From time to time we have shown up some of the early locomotives originated at the Norris Locomotive Works, Philadelphia, and with this issue show one of the last ones they built. This engine and tender were built October, 1860, for the Eastern Texas R. R., of which S. H. Witmer was superintendent, and she was named for him. During the war the "S. H. Witmer" was captured by the Federals, and used in the service of the United States Government, but was, at the close of the war, sold to a private party, and used for a number of years.

Pumps, cast-iron; ball valves, plunger, 1¾" diameter.

Steam ports, 13"x1½".

Exhaust ports, 13"x2½".

Lap, ⅝"; Link motion, iron case-hardened.

Lead, 1/16"; Radius, 66".

No inside lap; eccentrics 12½" diameter, 4½" throw.

Travel of valve, 4½".

Crank-pins (main), 3½" diameter by 3" long, by 2½" diameter by 2½" long.

Other crank-pins, 2½"x3".

Cylinders, steam chests, dome, checks, sand-box casing, and bands covered with Russia iron, brass mouldings.

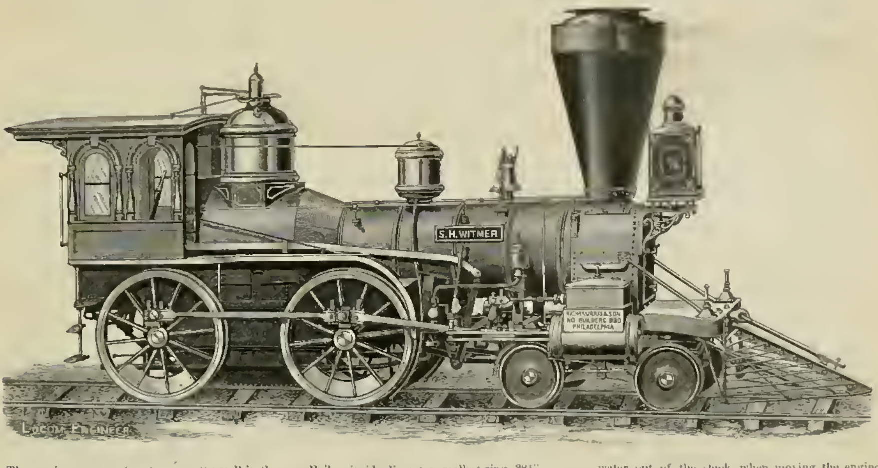
Frames, 4" wide, 2" thick or deep sides and top of No. 9 iron, frame covered with 3/16" iron, brakes on each wheel.

Weight, 20 gross tons.

Tried October 19, 1860.

The N. P. road are putting in the new style Baker heaters in their cars. Although they spent a great deal of money experimenting with steam heat, they are not satisfied with it for long trains of ten or twelve cars in their cold climate—all the locomotive wants to do to pull the train.

A muffling device in the front end of the N. P. engines does not seem to prevent the throwing of water out of the stack, when moving the engine after a long stand. Some of the boys have an old canvas tarpaulin that they stretch from the sand-box to the headlight to catch the scum, from the house to the train.



The engine represents a type pretty well in the advance of locomotive building thirty years ago, well remembered by old-timers, but hardly understood by the younger portion of railroad men. While sizes have more than doubled, the general plan of the American 8 wheeler has not undergone much change—just observe the difference in size of this locomotive's parts, and the ones you are now familiar with. The following data was taken from the original order books of the works:

Engine and tender, "S. H. Witmer," built for and sent to Eastern Texas R. R. Gauge of road, 5½ feet. Fuel, wood.

Cylinders, 13"x22", horizontal.

Drivers, 60", axles, 6", wrought tires, 2½" thick.

Truck, 28", axles, 4", cast-iron, chilled.

Tender, 8-30", axles, 4", cast-iron, chilled.

Tubes, 100, of copper, 10 feet 6 inches long, 2 inches diameter.

Boiler, inside diameter smallest ring, 38½".

Plates, 5/16"; tube sheets, ½" back, 7/16" front.

Boiler shell, 54" long, 48" wide; throat, 30" deep, largest diameter waist, 47⅝".

Stack, Yankee, 16 feet from rail.

Piston rods, 2½" diameter, wrought-steel.

Steam pipe, 4½" diameter inside (of copper).

Fire-box, ¼" iron plates; 48" long, 39" wide, 61" high; crown sheet, 3/16", iron.

Wheel base engine and tender, 36 feet 6 inches.

Wheel base engine (alone), 19 feet 8½ inches.

Diameter and length driving axle journal, 6 inches by 8 inches.

Diameter and length truck axle journal, 4"x7½".

Diameter and length tender axle journal, 3½ inches by 5½ inches.

Cab of oak (varnished.)

Tank capacity, 1,700 gallons, bottom, 3/16" iron.

The boys on the Lake Shore are getting to like the plan of lagging and jacketing the boiler-head in the cab. It is cool in summer, and comfortable enough in winter, they notice that they do not take cold so easily in getting off to oil or do other outside work—there is not the change in temperature.

Baldwin's have recently delivered 40 heavy passenger engines for the Mo. Pacific, several small engines (wide gauge) for South America and Cuba, a number of mining engines, and some street car motors for a suburban road at Denver, Col.

Watson & Stillman, of this city, have brought out a small hydraulic jack for use in renewing journal brasses under cars; it is small, neat, capable of lifting six tons, and is much quicker than the little old screw jacks universally used for this purpose. It is provided with a neat side handle for carrying.

The Knoxville, Cumberland Gap & Louisville Railway was opened on the 22d day of August. A coach, containing fifty-six prominent citizens, went through a faulty trestle, killing three and wounding forty-one. Rather a bad advertisement for a new line.

Angus Sinclair will sail for Europe on the 25th. He has been taking lessons in French and reading up on the compound. Next year's discussion on the compound locomotive will find him loaded.

An alligator wrench will often save many dollars in the cost of delay caused by a breakdown. We could never see much reason for refusing to furnish them for locomotives.

The N P Railway will soon commence the building of extensive shops at Tacoma, Washington. The plans are already in the hands of the Supt. of Motive Power.

The Traveling Engineer.

By J. E. Phelan.

FIRST PAPER.

No matter what his title may be—be it Road Foreman of Engines, Road Foreman of Machinery, Inspector of Locomotives, or other title with similar duties to perform, such genius is always best known among railroad men as the Traveling Engineer.

This innocent official is often used by clever engineers as a convenient scarecrow to stave off undesirable deadheads seeking something better than a tie pass out of or into the country.

At odd times, but often, the traveling engineer makes the most convenient mark for censure or condemnation when a necessary rule is to be enforced or some little innovation started about general service, requiring an extra ounce of exertion aside from the well-worn routine, but they get there some how.

We have known real smart individuals to take it for granted that an engineer would be reported for drinking simply because such a fact or assertion had been made in lodge or division meeting, where such assertion accidentally found expression in hearing of the traveler.

less influenced by a fellow feeling for associates, with ability to comprehend all that is good and commendable, while at same time showing nerve enough to condemn false methods and lawless practice wherever found.

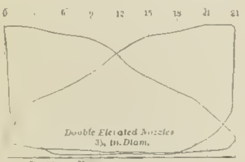
Few positions in railroading are better advertised among engineers and firemen than this one, and few positions so generally misunderstood, even by men attempting such duties.

The duties of the position of traveling engineer vary on different railroads.

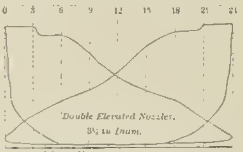
On certain roads the duties confine this titled individual to work about the shops, but mainly with most roads the duties lie on the road away from shops and headquarters.

Rule 222 of Transportation Rules of Northern Pacific R. R. reads: "The Road Foreman of Machinery is the representative of the Master Mechanic on the road, and his instructions relative to the care of engines, loads of engines, and use of fuel, and all other matters in the Machinery Department, will be obeyed."

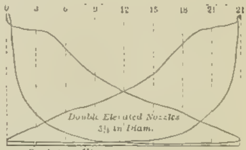
Instructions to Road Foremen of Machinery issued by Supt. of Motive Power on same road reads: "The revenue of transportation is earned in movement of trains, hence the proper condition of engines to perform this duty to a maximum capacity is of first importance.



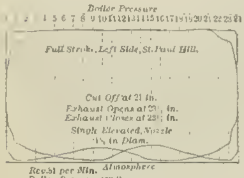
Rev. 81 per Min.
Boiler Pressure 150 lbs.
M.E.P. Forward End 88.5 lbs. Back End 85 lbs.
Cut Off, 9 in.
Horse Power developed in one Cyl. 211.4
Scale of Spring 30.



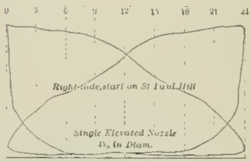
Rev. 155 per Min.
Boiler Pressure 140 lbs.
M.E.P. Forward End 64 lbs. Back End 65 lbs.
Cut Off, 6.5 in.
Horse Power developed in one Cyl. 269.5



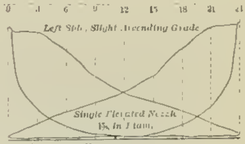
Rev. 162 per Min.
Boiler Pressure 140 lbs.
M.E.P. Forward End 49.2 lbs. Back End 48 lbs.
Cut Off, 4 in.
Horse Power developed in one Cyl. 213.6



Rev. 51 per Min.
Boiler Pressure 150 lbs.
M.E.P. Forward End 124 lbs. Back End 121.5.
Cut Off 21 in.
Horse Power developed in one Cyl. 3.3.



Rev 125 per Min.
Boiler Pressure 150 lbs.
M E P. Forward End 83.7 lbs. Back End 83 lbs.
Cut Off, 9 in.
Horse Power developed by one Cyl. 317.5



Rev. 162 per Min.
Boiler Pressure 135 lbs.
M.E.P. Forward End 43 lbs. Back End 43.5
Cut Off, 4 in.
Horse Power developed in one Cyl. 216.8

Single vs. Double Nozzles.

On this page will be found two sets of indicator diagrams taken from engine 404, on the Northern Pacific Railroad, one when equipped with a single, the other with double nozzles. The upper set of diagrams were taken when using the double nozzles, the lower with the single. It will be seen that at full stroke, when working hard on a start, there is a slight back pressure caused by the single nozzle, but that it entirely disappears when engine is cutting off short of full stroke.

These diagrams were taken by O. H. Reynolds, chief draftsman of the road, and a mechanical engineer who could, from his own experience with the indicator in locomotive practice, enlighten the enginemen of the country, were it not for his besetting sin of excessive modesty. The cards shown show good steam distribution, and remarkably good valve setting, and are a credit to the motive power department of the road.

This is the sensible way to investigate the single nozzle, which has not shown improvement enough to secure the adoption of the single nozzle on the N. P., but, so far as the cards go, one is as good as the other; the single breed is cheapest to make, however.

The 404 has 18x24 inch cylinders, valve travel 5¼", ¾" outside lap, and is line and line inside.

The diagrams are reduced to $\frac{4}{9}$ the original size, the originals being about two and a quarter times larger.

In the bright imagination of some men, the individual filling the position of traveling engineer embodies the principles of a sewerage system, through which flows all the slime of scandal or contemptible gossip current about bar-rooms, depot platforms or roundhouses, into the general office of the R. R. Co., regardless of conditions or circumstances.

The fact that men attempting to fill the position of traveling engineer occasionally or often interpret the duties of the position to require such services is simply to be deplored.

Few in service can find opportunity to do more harm or cause more trouble than the traveling engineer, if so inclined, where such work is tolerated by the management.

No official on the pay-rolls of a R. R. Co. can be of more benefit to the requirements of good service than the traveling engineer. This position should at all times be filled by men of accurate judgment and honest motives, who possess courage enough to speak the truth at all times, or when necessary show sense enough to maintain judicious silence.

If this position cannot be filled in a creditable manner it better be abolished.

Working daily among engineers and firemen, few men have better opportunity to observe commanding traits among this class of associates than the traveling engineer. Few men are given a better opportunity to represent or misrepresent engineers and firemen than the traveling engineer.

A man cannot make a success of the position un-

"Road foremen should know the condition of all engines, and report to the division officials whatever may be found that interferes with the economical and proper performance of same.

"The use of fuel must be watched, with a view to the strictest economy, and the instructions to engineers and firemen in this respect should be constant. The delivery of fuel to engines, and its quality, should also be noted.

"The proper use and care of engines, the use of oils, condition of air-brake apparatus, smoke-stacks, ash-pans, wheels and tires, the condition of water machinery and water supply, are all matters to be noted, and defects reported upon in such manner as to insure attention.

"On passenger and freight trains note the use of air-brake apparatus, and instruct train men how to use it.

"The trials of new engines, and new men on engines, will generally be under the charge of Road Foreman of Machinery."

This and more embodies the main duties of the traveling engineer on the N. P. system.

Such a position can be raised to a plane of decency and respect or it can be made the target of ridicule and contempt.

Much of course depends on the way a man occupying the position is built. A man occupying the position of traveling engineer cannot expect to suit everybody, and should not even try to do so.

First know how to judge correct methods and proper principles, and insist on such being practiced and observed, together with all rules of the company designed to insure good service.

Practical and thorough knowledge of firing, and the proper maintenance and management of locomotives, is absolutely essential to success. Backed by an intelligent understanding of such principles, and possessed with a fair degree of self-reliance and assurance, a man may fairly count on success.

Starting in the performance of such duties, however, a man had better show a disposition to gain knowledge and experience from others than to assume to know it all.

One mind and one set of faculties can never be equal to the results of combined observation and discernment of many minds.

A man starting in with ability to glean from the knowledge of others can make far better success in any position than the "thing" who knows all that may be worth knowing from Adam's time to the coming of Gabriel.

It does a man good occasionally or often to admit learning a new phase in practice. It is but justice to the man imparting knowledge gained to get due credit for the same.

Look around and note the principles of men who have failed in advancing in the line of duty or who fail to accomplish desired results, and you find men rendered incapable of doing justice to others through selfish or mercenary motives, or else men so dense in their mental machinery that a ray of understanding becomes discouraged before tapping at the door where reason is supposed to dwell.

The travelling engineer works among and becomes associated with engineers and firemen who, in general, as a class, have no superiors in appreciation of fair treatment.

No class of men more readily understand whether a superior in position is fitted for the place occupied or adapted by experience for duties to be performed.

An occasional specimen, however, two-thirds mercenary, will always find fault with the travelling engineer. But such specimens must be classed among those impossible to suit, and handled about as an engine of very poor design. The builder in either case is responsible for imperfect design or poor material. Time alone will demonstrate the quality of material.

Pedrick & Ayer, Philadelphia, are moving into their new shops. They are working every man they can, and are behind with their orders.

An Ingenious Drill.

We illustrate on this page an ingenious drill, designed by Pulaski Leeds, Supt. Motive Power of the L. & N. Ry.

The device, as shown, can very properly be called a radial attachment for a drill press, but can be used any place, and driven by flexible shaft or otherwise.

Fig. 1 shows it as applied to the drilling of set-screw holes in eccentrics from the inside of the axle bore, and without boring a hole through the outside bearing of the eccentric; this prevents the set screws from working out and catching in the oil-holes of the strap, stripping the motion on that side.

This tool can be put to work in any small space, where even ratchet tools will not go, and is found very convenient about frames, especially in patching, as it can be made to work from the inside of a pair of jaws, in the end, or under the frame.

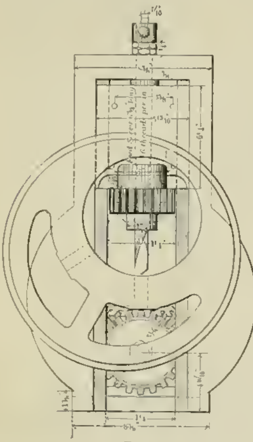


Fig. 1

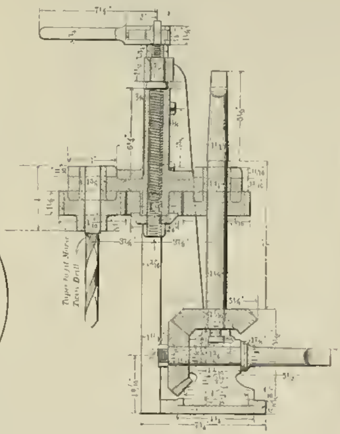


Fig. 2

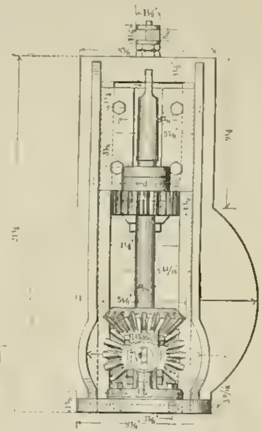


Fig. 3

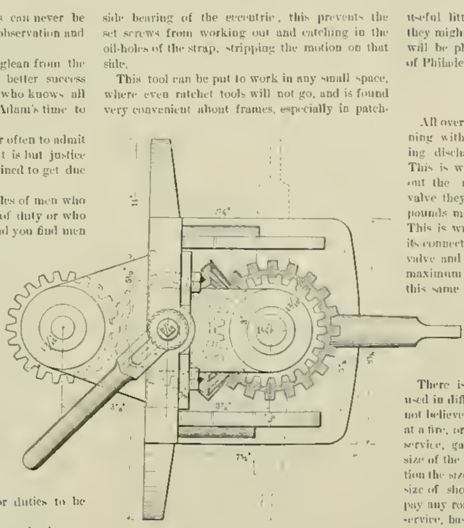


Fig. 4

Fig. 1 shows a front view of the tool, and shows the frame. Fig. 2 is a sectional side view, and shows the arrangements of the moving parts; as will be seen, there is a horizontal as well as a vertical taper spindle to drive the tool. When the work is done by the vertical spindle, the other simply runs idle, and when it drives, it does so through the vertical, the object being to drive from the most accessible point; the lower spindle shown in Fig. 2 can be turned around to any angle, as shown by dotted lines in plan view, Fig. 4.

The feeding is done by the screw at top, which moves the crosshead in frame up and down; the crosshead carries a small idle wheel at the bottom, which meshes into the one on the driving spindle and the one which forms the chuck for the drill; these gears are shown in plan view, Fig. 4.

Of course, by shortening the drill, a great deal of work can be done in very cramped places.

We believe that this tool will prove one of those useful little repair shop devices—universal jigs, they might be called—that will become popular. It will be placed on the market by Pedrick & Ayer, of Philadelphia.

Bad Practice.

All over the country we find the engineers running with the new engineers' brake and equalizing discharge valve in the full release position. This is wrong, some think that by thus cutting out the use of the 20-pound pressure retaining valve they thereby charge their trains with 20 pounds more air for use in case of an emergency. This is wrong where a pump governor is used, as its connection to air pipe is above the piston of the valve and it will slow the pump down as soon as maximum pressure is reached there—you can have this same pressure under train, and twenty extra pounds in the engine drum to insure release, by running with handle of valve in "running position" or with indicator spring against the first stop.

There is a great deal of difference in the fuel used in different parts of the country, and we do not believe that any set rule of so many shovelfuls at a fire, or for a mile, can be settled upon for all service, gauging the number of shovelfuls by the size of the cylinders, and leaving out of consideration the size of fire-box, quality of fuel, service and size of shovel is also a little "unsartin." It will pay any road to issue special instructions for their service, based on well-established laws of combustion, but modified to fit the case in hand.

On a recent raid on the Baldwin Locomotive Works, we noticed on many boilers in its erecting shops, a new arrangement of wash-out plugs, instead of the plugs being screwed directly into the boiler sheet, they screwed into a brass shell that was bolted by a flange to the sheet.

All the prominent locomotive works are busy, and the prospects of business for the next six months are good.

A Reading Flyer.

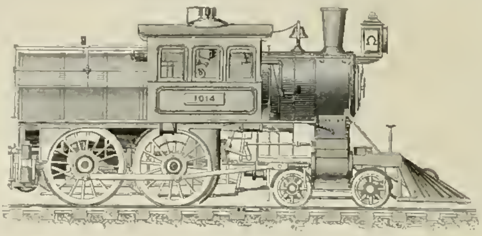
We publish on this page two views of the P. & R. Ry.'s fast express engine 1014. We publish this for two reasons; one to show those who have been asking us "What is a Wootten bake-oven like?" and one to show the style of engine doing the fast work between Philadelphia and Atlantic City—a train that has caused considerable talk among the traveling public on account of the high rate of speed.

One correspondent sent us the picture used, and noted on the margin: "Extension back on fast roads, extension fronts on slow."

Another wrote: "I have rode over the Philadelphia and Atlantic City on the *fastest* regular train run in America."

The distance is 55.2 miles and the fastest train makes the run in 68 minutes, which is very lively time for a regular diet.

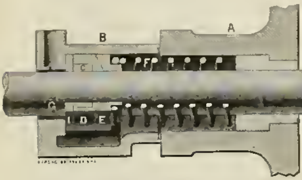
The Pennsylvania's No. 19, leaving Jersey City at 4.13 P. M., has but 64 minutes to make Trenton, including station time there; this is a distance of 55.9 miles. This speed has been regularly made for the past twelve years, and no one seems to know of it or notice it.



A READING FLYER.

The Wootten locomotive is a unique piece of machinery, however, and those not familiar with them will be interested in the cuts. The engine is the same as any 8-wheeler, the boiler being the only "Wootten" part of the machine.

The following dimensions were kindly furnished by the Baldwin Locomotive Works:



THE EXCELSIOR PACKING FOR VALVE STEMS.

The principal dimensions of locomotive No. 1,014, built by us for the Atlantic City Railroad, are as follows:

Gauge, 4' 8½".

Fuel, anthracite coal.

Boiler, of steel, 9-16 and ⅝ thick, 57½" diameter at smoke box end, straight top longitudinal seams, triple riveted, circumferential seams, double riveted.

Fire-box, Wootten pattern, 102" long 96¼ wide, of Otis steel; crown sheet, ⅜", tube sheet, ½", side and back sheets, 5-16" thick; two fire doors, crown sheet supported by stay-bolts, ⅞ diameter, with heads and copper washers underneath crown, and bolt riveted over outside of shell; combustion chamber, 33¾ long.

Tubes, 324 in number, 1½ diameter, 9' 2¼ long.

Working steam pressure, 160 lbs.

Smoke-box with register in door and baffle plate; Wootten style.

Weight in working order on truck, 33,050 lbs.

Weight on main driving-wheels, 31,450 lbs.

Weight on rear driving-wheels, 30,690 lbs.

Total wheel-base, 20' 5⅝".

Driving-wheel base, 6' 6".

Cylinders, 18⅛ diameter by 22" stroke.

Steam ports, length, 16¾, width, 1¼"; bridges 1¼.

Exhaust ports, 16¾" x 3¼".

Valve travel, 7"; outside lap, 1¼; inside lap, 1-64"; lead, 1-16".

Driving-wheels, 68½" outside diameter; centers, 61½".

Tires, 3½" thick by 6¼" wide.

Driving journals, 7" diameter by 10" long.

Truck, four-wheeled rigid center pattern, with steel-tired wheels, 30" diameter.

Journals, 5¼" by 10".

Tender, eight-wheeled.

Tender frame, iron.

Tank capacity, 3,500 gallons.

Trucks with square wrought-iron frames equalized.

Tender-wheels, steel tired, 33" diameter, journals, 4½" by 8".

The locomotive is equipped with Philadelphia & Reading Railroad Company's pattern steam reversing gear.

Detroit sight-feed lubricator.

Balanced slide valves.

United States metallic packing.

Channel side rods with solid ends.

Westinghouse quick-acting automatic brake for driving-wheels, tender and train.

Westinghouse train signal.

Post & Company's headlight, with illuminated side numbers.

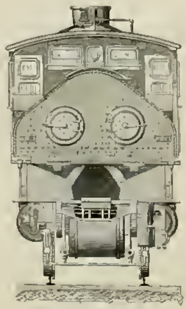
Bearings throughout are of Ajax metal.

A Fireman's Dream.

A short time ago the writer stood with Master Car Builder Barber at the coach shops of the N. P. road at Como, and watched with great interest the process of cleaning old brass. All brass trimmings, like door locks, sash locks, grip racks and car lamps are simply held in a steam-heated tub till thoroughly hot, and then dipped into a vat containing some cleaning compound, then into a vat of clear water, and dried in sawdust, all the pieces come out just as if they were new, bright as a dollar. We are informed that the process in no way hurts the springs, etc., in the locks.

Pieces like the blackened and blistered burners of coach lamps come out looking like such work when new, and just off a buffing wheel. The process was so simple, and the results so brilliant and satisfactory, that it made quite an impression on our mind; and that night, as we covered up head and ears to escape the assaults of the Minneapolis mosquito, we dreamed.

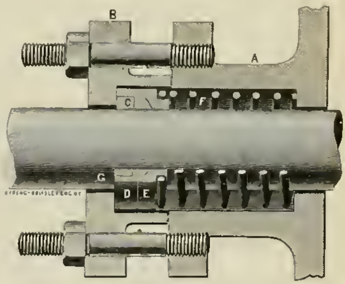
We were firing again, way back to the time when we first commenced trying to keep steam for old Paddy Flynn, with nothing better for fuel than ice with slivers in it; yes, it was the old 8-spot, double dome (brass), sand-box (brass), wheel covers (ditto), chests and cylinders (the same), and so forth, and so forth. We were coming into headquarters, and we looked into our seat-box at the collection of



WOOTTEN FIRE-BOX.

boxes of tripoli, rotten stone, emery, acid, sperm and lampblack, and wondered whether we had better scour in the afternoon or scrub her paint. We notice Paddy is slowing down, why, how's this? Yes, he's going in a big pit of something hot, and the track goes right through it. Paddy reaches over, and taking us by the nape of the neck, like a cat does a kitten, gets on top of the cab. Down we go into the scalding vat, up, out, down into another, and Paddy restores us to our seat. But what has happened to the "tray"? she is as bright as a gold dollar from the mint; there is no work for us to do this lay-over, alas! and alas! Ah! what's this? Paddy gives us a $5 bill, same one he borrowed two years ago; bliss indeed; but he is slowing down again, here's a line along close to the side of cab, easy enough to reach, and raisins, grapes, watermelon, cigars and chewing tobacco on it. Why, you bet we will just fill up the tank boxes—and we do.

Then we approach the terminal station, there's a big crowd there, and the minute the old three stops the train and then leans back against the bumpers, as though she were tired, a crowd of pretty girls in white come out and strew flowers in front of the left-hand gangway, and help us off, and give poor old Pat an order from the M. M. to take her to the house himself, and then pin bouquets on us, and escort us to a white carriage, where, seated on the petal of a pond lily, is our best and only girl; and we get in, and sixteen little bench-legged fairies fly away with us to—we are just wondering where, when we recognize the voice of the colored porter informing us that it's the last call for breakfast—if he had let us alone a minute more we should have been in heaven.



THE EXCELSIOR PACKING FOR PISTONS.

The Excelsior Metallic Packing.

This style of packing has been in use for a number of years on several roads, always with good success, but its systematic manufacture and sale has not been pushed until this year, when Watson & Stillman, of this city, commenced its manufacture. It depends on soft metal for all its steam-tight joints, no ground joints being used, it has less parts than any other metallic packing we know of.

The two rings, *C* and *D*, are the anti-friction rings, which fit tight against the face of the case *B*, and also between themselves, as shown.

The ring *E* and spring *F* serve to hold them in place when rod is on back stroke.

A patent concave copper packing ring is clamped between the faces of *A* and *B*.

The steam pressure keeps the rings tight on the rod and closes them up when they wear. It is claimed that the pressure on the rod is greatly relaxed when engine is running shut off—a feature that has enabled this packing to become a success on mountain roads where others have failed. The steam rings *C* and *D* are prevented from turning and presenting both openings at the same place, by a rib on one and a groove on the other—not shown in cuts.

The packing case on valve stems has a cellar into which the packing can go as the rod settles.

We recently saw a set of this packing that was taken out of a Jersey Central engine after a year's service that the engineer declared was as good as new.

The man who is going to lay a sea-serpent smoke-stack the full length of the train, and make "the flyer" look like a rocket on a drunk, is with us again.

The Smith Exhaust Pipe.

We have received from the secretary of the Smith Triple Expansion Exhaust Co. the following letter, which, if the work performed was the same in each instance, shows a remarkable saving of fuel by the use of the Smith device.

Bell's Gap Railroad Company.
Clearfield & Jefferson Railway Company,
Office of the General Superintendent.

Bellwood, Pa., August 3d, 1889.

Henry Lear, Esq.,
Sec'y S T E. P. Co.,
Doylestown, Pa.

Dear Sir · Referring to the Smith triple expansion exhaust pipe, at present in use on our Bell's Gap R. R. engine, No. 14, I beg to enclose you herewith a comparative statement of coal consumed by engine No. 14 and B. G R. R. engine 12, the latter being a consolidation freight engine of the same weight and type as engine No 14 The coal used was placed on the engines at the same tipple and was from the same colliery. I would further say that the pipe is giving good satisfaction, and we trust you will forward the additional pipes ordered as early as possible, to oblige,

Robert G. Ford, Gen'l Supt

Correspondence

On Measuring Indicator Cards.

Editor The Locomotive Engineer.

In Mr. Cyrus F Richmond's third paper on "Indicating Locomotives," in the August number of your paper, I notice the statement that, in measuring the length of ordinates on indicator cards, "a scale must be used that corresponds to the number of spring that was used."

Such a scale is convenient, but not necessary.

The "No of spring" to which Mr Richmond refers, represents the number of pounds pressure per square inch which one inch vertical movement of the pencil on the card will show with that spring.

Hence the indicated pressure at any point on the card can be obtained without the use of such a scale as Mr Richmond mentions, by simply measuring the corresponding ordinate in inches and any convenient fraction of an inch, and then multiplying the reading by the "No. of spring" used.

For instance, if the No. of spring was 80 and the length of ordinate is 1½ inches, then the pressure was 80 times 1½, or 120 lbs

Brainerd, Minn. Frank M. James

Can you tell me where I can get some indicator diagrams taken from locomotives, that I may study them up and thereby learn something of them. Hoping the L. E. great success, and to see the profession of steam engineering go up, I am,

Somerset, Ky. J. S. Johnston.

[The cause of pins heating in the center of bearing first, is the springing of the brass by the key Forcing the key between the end of the rod and the brass makes the center bind the pin, heats all, and produces just what our correspondent has observed—key carefully]

A Little More Cut-Off.

Editor The Locomotive Engineer:

There has been so much debating pro and con of late about the question of full throttle and short cut-off, that it is time some one *side-tracked* the whole business Each correspondent evidently thinks he is right and all others wrong. That is human nature. Why can't you agree on some happy medium, and let up on this paper and pen quarrel. I used to watch the reverse lever when I was firing extras on one of our prominent Ohio roads, and I always had the easiest trip with the man who hooked her back close to the center notch (always providing the engine was a good steamer and she was pumped in any decent kind of manner.

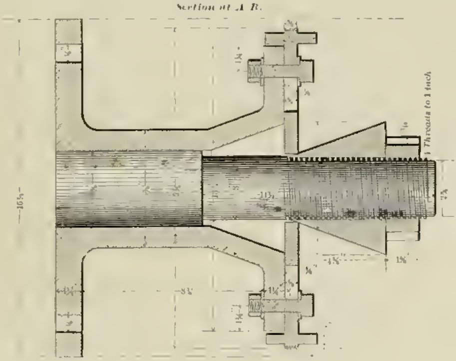


Fig. 1.

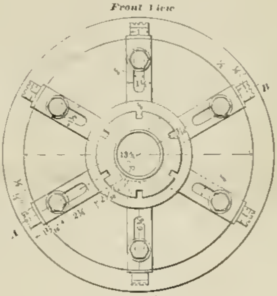


Fig. 3.

Engine No 12. Plain Pipe and Nozzle		Engine No 14. Smith Exhaust Pipe	
July 26th	10,500	July 26th	8,000
" 27th	9,500	" 27th	8,500
" 30th	10,500	" 30th	10,000
" 31st	13,700	" 31st	4,500
Aug 1st	15,000	Aug 1st	8,000
" 2d	11,000	" 2d	10,000
	70,200		49,000
35 1-10 tons		24½ tons	

A saving of nearly 11 tons of coal in six days' work.

Chuck for Holding Packing Rings.

The accompanying engravings hardly need explanation, sizes being given, and the use of the device obvious. The chuck is placed on the spindle of lathe, same as a face plate, projecting out far enough to turn the deepest blank: the jaws are forced out evenly by the cone, and the cone held by the jamb nut, as shown; the jaws have shoulders on them to hold the rings true while the face or side is being trued up. This device was gotten up at the N P. shops at Brainerd, some years ago, and they are in use at all the shops on the road, giving good satisfaction.

We are informed that there will be an attempt made at Denver to have a law passed prohibiting members of the Episcopal church or the democratic party from becoming members of the B. L. E. We hope this will not become a law, and trust the members will sit down upon it—still, it is as reasonable and as fair as the laws against the firemen —just about.

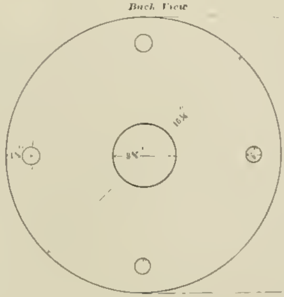


Fig. 2.

Packing Ring Chuck

About the Heating of Pins and Bearings.

Editor The Locomotive Engineer:

I have been taking the Locomotive Engineer since January, and must say I like it very much Think it the best paper of the kind I ever saw

I would like to ask you some questions, as I don't profess to know it all, but am trying to learn all I can. I have been noticing for some time the heating of pins and bearings of different kinds, and seems to me that they always get hottest in center, and get hot in center first. Please give the cause I have had old locomotive engineers tell me the same thing about pins and bearings.

(The Lord deliver me from the man who will let his water get almost out of sight and then try to get her slopping it out of her stack in the shortest time possible.) This full throttle and short cut-off business will work on a level road and it will work on a hilly road on level stretches and such favorable places, but it *won't* work with all kinds of engines on all kinds of roads with all kinds of trains in all conditions of weather, and all the engineers, firemen, master mechanics, etc , in creation couldn't make me believe otherwise. I have always studied to make the best possible use out of fuel when firing with men who handled the throttle, reverse lever and pump or injector intelligently, have had good success. With these *I don't care how just so I get there* men I have nothing to say, only that *I* got there This coal saving business is not confined entirely to full throttle, etc , by any manner of means. I guess you will admit that a fair per cent. of it is due to intelligence in pumping or working injectors.

As to engines riding bad when working with full throttle and cutting off very short, I believe they are worse with a light train than with a heavy one, and I know that some engines are worse than others.

How about center of gravity, heavy counterbalances and lost motion in various places? I think they all contribute to make an engine roll, dance and hippity-hop around when cutting off short. I will say in conclusion that I work an engine in the notch that takes her over the road on time, be it down among the oil cans or in the center. I don't ride hobbies, but I do advocate economy W R. Cline.

McArthur, O

Dangers with the Air-Brake.

Editor The Locomotive Engineer:

A train of twenty-five loads (four air) running 30 miles an hour, broke in two behind second car just as we opened out in bottom of sag. We were two car lengths ahead of hind end before we realized what had happened, and had to hustle to get out of the way. The engineer put his valve at lap, but I think he should have used reservoir pressure to *help* release brake, and so have a better chance to get out of way. We run many trains with only three or four air cars. Is not the possibility of accidents of this character worthy your attention?

Goodland, Kan. WILL. MCLELLAN.

[With automatic brake, the danger referred to is not great for such a break; had the engine been provided with an automatic driving brake, the probabilities are that she would have been held against the train.

The beauty of the automatic is this fact, that the cause of danger—the parting of the train—is the very thing that sets the brake, and prevents the broken sections from separating far enough to do damage.

Your engineer did right in putting the valve at "lap," for he then preserved his reservoir pressure to release the brake when the opening in the train pipe was closed

The placing of valve at "full release" could not "help" let the brake off, unless it could maintain a pressure in the train pipe *greater* than that in the auxiliary drums, by turning his valve to release, he would have simply wasted air at the open hose, and not been in position to release brakes when the train pipe was finally closed.]

Explanation of the Valve Gear of Eastwick & Harrison Locomotive.

Editor The Locomotive Engineer.

The "mechanical business" in the steam chest of the old Eastwick & Harrison engines (with some of which, on the Balto. & Ohio R. R., the writer was familiar in his earlier and their later days), and about which your correspondent, W. de Sanno, wants to find out, was *a movable reversing block*, which was interposed between the valve and the cylinder valve face, or what would be such in an ordinary engine, and was moved forward or backward for forward or back motion respectively, by a rod corresponding with that marked F on his diagram The valve worked on the upper face of this block, and the lower face of the block fitted truly against the cylinder valve face

Five ports were formed in the reversing block, the central one passing directly through it, and being in communication with the cylinder exhaust port and the exhaust cavity of the valve, in either position of the block Near each end of the block there was a port which extended vertically through it, and in the forward motion position of the block these ports stood directly over the cylinder steam ports, thus enabling the valve to admit and exhaust the steam in the usual way. Adjoining these direct ports were two back-motion ports, set the same distance apart as the cylinder steam ports, but extending through the reversing block in opposite directions, that is to say, the bottom opening of each port was at the opposite end of the block from its top opening

When the block was moved into position for back motion, the bottom openings of the ports last mentioned communicated with the cylinder steam ports, and steam admitted to the port at the front of the valve passed to the back end of the cylinder, and *vice versa*. In other words, instead of reversing the position of the valve, as in the then and present standard practice, the movement of the block reversed the position of the steam port openings, relatively to the valve, and thus enabled one fixed eccentric to serve for both forward and back motion

If time permitted, the above could be made clearer by a sketch, which would also indicate what is, however, perhaps self-evident, viz., that the unavoidable cramping of the back motion ports prevented the engine from backing as well as she would go ahead. J SNOWDEN BELL.

Pittsburgh, Pa.

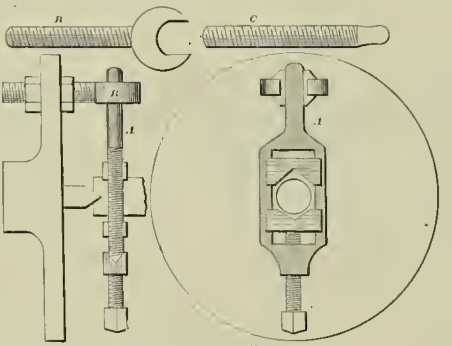
A Lathe Dog Kink.

Editor The Locomotive Engineer:

Will you allow me to contribute something to "Shop Kinks"? There is great trouble with the ordinary lathe dogs in use, in their tendency to twist around and throw the work out of the lathe, also in the slack in the hole or slot in the face plate promoting the evil.

To overcome this trouble, I made a lathe dog as shown in *A A*; it is an ordinary die dog, except that the shank is straight, as a driver I used a stud with a forked end. *B B* shows two views of it, and how it is secured to the face plate, and engages the dog; also used a plain stud, *C*, in my work, as it often happens we get work with a hole in one end, like a guide block, the stud *C* has two nuts on it; put it through your work, set up the nuts and use the forked stud *B* as a driver. In turning and cutting taps, put the work in the lathe and give the stud a twist, which takes up all slack between the fork and shank of dog. Make the studs about 6 inches long by ¾ diameter.

Inasmuch as lathe shears look better to be clean and bright, I had two brackets made out of 1x¼ iron, and bolted them on the back part of the lathe carriage, to which was secured a shelf about ten



A LATHE DOG KINK

inches wide and the length of the carriage. It made a very handy place for lathe tools, oil can, etc and was always in front of the work. To keep chips off the floor, get dirt-box made no wider than lathe shears, and as long as you please, get two hook-bolts to hook over the web cast between lathe shears, and put nuts and washers or strip of flat iron on underside of box and draw it up tight against bottom of lathe, hinge the opposite or back side of box to facilitate cleaning it, and you can keep everything neat and clean in and about your lathe.

These things are not patented; use them.

W. DE SANNO,

Tulare, Cal. Engineer and Machinist.

About Lift of Pump Valves.

Editor The Locomotive Engineer:

Will you kindly give me, through the columns of your paper, the following information as to which of the following arrangement of pump valves will give the best results, in general service:

Lift of lower valve........ .... ⅛"
" top or middle valve......... $\frac{5}{16}$
" check valve.... .... ¼"
Or lower valve .. .. ¼"
" top or middle valve... .... . $\frac{5}{16}$
" check valve. .... ⅜

Ft. Worth, Tex. Signed, G T

[There are many conditions that ought to be taken into consideration when talking about pumps. A pump will do well on a slow run that would be useless on a fast one, and one exactly right for a fast run will not do as well as one differently arranged on slow work; but to answer the question which way one will work best and give best general results, is the one that has ¼" lift on lower valve. We do not think the one with ⅛" on lower valve could be run with any satisfaction on a fast train; it would knock a pump all to pieces in a very short time. Before any one can give good advice in a matter of this kind, it is necessary to know size of plunger, size of valves, also size of air chambers on both sides of pump, and what are the limit of speed the engine is to run, as well as size of wheel.]

Don't

Editor The Locomotive Engineer:

I would say a word to firemen. If a strange man goes out in place of your regular engineer, *don't* start in to tell him how to run the engine; just keep right along at *your* work. If he handles the engine different from Charley, but gets there all the same, notice where they differ, and which have the best points, if he thinks best to carry lots of water, and you find the engine steams just as well, *don't* tell him Charley only carries half a glass. I ran for another man once, and I believed in keeping the glass up within an inch and half of the top. The fireman spoke to me about it, and said Charley only carried a little in the bottom of the glass, and sometimes very little in sight, and he banged the coal to her right along; *he* did not believe in the full glass. We might say right here, Charley is off the road for trying to keep the glass empty, but it was a *bar-room glass*. I supposed a case to this fireman: Suppose something should happen that the water would run out of the tank suddenly? With low water in boiler you would be on your back; or, again, you were switching and dropped off the track; tank hose gets torn off; no water in boiler, you must pull your fire and die right there. When it comes to steaming, a boiler full of water is not so sensitive to the pump or injector. I just supposed these and other things to him, and he is now a high-water convert. If your strange engineer *don't* start from a station in two movements, to wit: pull out the throttle, and pull up the lever in the center—*don't* tell him that is not the way Charley does—and then step over and haul up the lever on your own responsibility, as I had a man try on me once. If you are on time freight, have your fire in such a condition that the engine can git up and git, and if your new man handles the throttle and lever each a little at a time, and she steams just as well, and you get there just the same, put on your *thinking* cap, and for decency sake, when you go back, and some one asks you how about the new man, *don't* shrug up your shoulders, try to look wise, and say he is N G If you live long enough to be "sot up," be merciful to the engine, ninety-nine times out of a hundred the first thing a young runner does is to get an old hammer-hardened (so-called soft hammer), and set screw wrench, and just go after the rods, and the side rods get the worst of it, *don't* do it. If any one asks you how is the old 11? don't say she would be all right if she was fixed up, but she is all in pieces; perhaps you have been firing this very engine, and have just discovered her faults; at the same time the engine has been doing good work right along. Now this idea is not confined to firemen. I had occasion once to turn my engine over to another man while I was off on a trip. She was a 15x22, 48 inch wheel, and was used for special service It was not an uncommon thing to make fifty miles an hour with her on a special. I had to run her side rods loose; this fellow—and he was an old runner—would not have things that way, and called the attention of other men to her; he keyed up everything, took her out on a *freight*, and melted the babbitt out of her rod brasses. *Don't* condemn things you know nothing about; *don't* say that such and such an engine has too much lead, or she has no lead, or her valves want some of the lap cut off I went to the slate one day in the roundhouse to look at a report a young runner had made about an engine that had just been rebuilt, new fire-box, etc., but she was unfortunate in falling into this fellow's hands. "Engine 0 wants her valves squared in six inches; she is not square; she don't steam, the engine is no good, in fact, she is not safe "

(Signed) JOHN DOE

"And the villain still pursued her." *Don't* begin your engineer's life by kicking, finding fault with every engine that is unfortunate enough to fall into your hands, *don't* try to be wise by reporting a lot of imaginary work; *don't* try to walk like an old, broken-down engineer; *don't* ring in your experience amongst a lot of old footboard stagers —you have had no experience worth speaking of, *don't* come in and say *I* had a picnic, got laid for twenty-six, and old Willis held me two hours in the sand cut; when, if the truth was known, Willis got tired waiting for you to show up, and found you in the sand cut, beating the life out of your sand pipe, trying to make the engine steam. If any one asks, "What do you know?" just tell him that you know less than you did when you was firing, and that you *don't* know half as much as you will in ten years hence, *don't* get a wrench and heave on a set screw as hard as you would to screw up the nuts on the draft rods of your tender; *don't* try to wear a hat that is two or three sizes too large for you; *don't* imagine that because a man is not a Brotherhood fireman, or engineer, that he is a dumphool, and *don't* know anything about an engine; when you see a new valve motion, *don't* call it a "monkey" motion, simply because you do not understand it. Be a sensible man, and *don't* forget these admonitions; *don't drink whiskey*, but *do* read THE LOCOMOTIVE ENGINEER, and be happy, "and you will get there, Eli!"

Tulare, Cal. W. DE SANNO.

Reminiscences of Some Old Valve Motions.

Editor The Locomotive Engineer.

I note what is written in August number of the LOCOMOTIVE ENGINEER, under head of "From the Western Land." It is my opinion that a locomotive built with either a drop or V hook did do more and better work with less steam than they could do after being rebuilt to a link As I understand W. U. Junction, he was well acquainted with the engines in question. If so, why should he ask me to say how many eccentrics the 11 and 12 had, and how located or arranged, unless he wants to see if I know anything about these engines? Well, Mr. W U J., as to the number of eccentrics, there were four, same as our link engines now have, and set in same relation to the crank, providing cap and head of valve were the same Now, W U J may ask if there were but four eccentrics, what gave motion to the cut-off? Please remember, these engines in question were *inside* connected the motion for cut-off was given by an arm on forward crank-pin, this arm extended towards the center of axle At this end of the arm was a pin, the center of which was *not* over the center of axle, but remote from it enough to make the required motion. A rod was connected to this pin in the arm and to the lower arm of a rocker set on the running board, the upper arm of this rocker was curved to fit the length of a radius rod that connected to and gave motion to the valve stem. The end of this radius rod that coupled to the curved upper rocker arm was connected to a block that was fitted to this curved arm. In working, the farther this block was raised from the center of this rocker, the finer the cut-off When the sliding block was dropped so its center came just opposite the center of rocker, there was no motion to valve, but the ports down through the cut-off valve were, or should be, wide open. I have found them *not* wide open when in this position Now, all this is nothing new to W U. J. if he knew the engines well, and should he reply to this, I would like to see him sign his name, it might be I may know him I further know more about the old St. Paul R. R, back to the time it was the La Crosse & Milwaukee R R If there are any of your readers who were on deck about them times, would like to hear from them.

I note about the Stevenson balance valve casing or riding valve cut-off, *all balanced*. Why is not this something good for a locomotive, notwithstanding the *howl*, and where is the M. M who has confidence enough in the good qualities of a good V hook motion for main valve, with a riding valve cut-off to advocate its goodness by giving it a trial? I well remember of running a Fairbanks engine in New Hampshire about 1855, that had the V-hook and reversible cut-off, but not on the back of the main valve, but like the Lawrence engines 11 and 12, and it will be admitted, I think, by most engineers, that a man is full as likely to run as fast the first year as any in his railroad life and I can assure you, Mr. Editor, I never saw that engine run, but what she would feel an *outward* movement of the throttle. This, I would say, indicated freedom in working the steam. I have seen many link engines, some that were not so affected. It did not seem by their action that a *wide-open throttle* gave any more life to the engine than when half open. Was it not a small wheel Taunton, V-hook, variable cut-off, engine with which Jim Wood, on the N Y Central R. R, made his first fast time years ago—the then fastest time over that number of miles ever made in the U. S.?

What is wrong with this riding valve cut-off motion? My limited knowledge of railroading, gained in an experience since 1851, says there is nothing The regular *howl* of too many pieces and parts to *make* and *keep up*, that was the old tune, but to-day we ought to be able to put up pieces and parts with steel and with case-hardening, and by using lead packing, to give this—*the lost valve motion*—a good, solid, fair trial, for when I think back to the time of 1855, I can remember some cases where it required pretty good movement on part of conductor to get onto the last of four cars when starting out from a station. I would go some way to see one of our first-class locomotives, equipped with cut-off, say 18x24, 66" wheel, boiler 60, steam 180°, all other parts being equal, buckle onto a passenger train, and see what she could do with it as compared with an engine of like dimensions with a link I give these dimensions of engine and pressure of steam, as in the days just mentioned of the V-hook there was no such engine built or such pressure carried H. KINGSLAND

Ft. Scott, Kan.

An Air-Brake Puzzle.

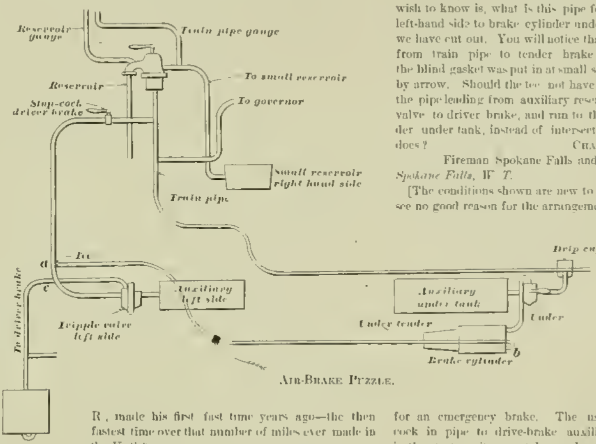
Editor The Locomotive Engineer.

I have been a subscriber to your valuable paper for some time, and have read it with a great deal of interest, especially the articles on Air-Brake Practice, by Mr. J. E. Phelan, and I would like, through the columns of your paper, to get a little information on an air-brake kink which has been, and still is, a sticker for us *all* here, as it was for the man who came with the engines and set them up. He left here, leaving us no wiser on the point than when he came, and the blind gasket was placed in the union shown in accompanying sketch at his suggestion.

The brakes are fitted up on two new Baldwin engines, as shown in sketch, and I will proceed to explain to you how they worked. In the first place, when the engines were all set up and in steam, the pump was started, and 80 pounds of air pressure jumped up, the small stop-cock below engineer's valve was opened, and the tender brakes set themselves. Right here is where the circus commenced. We kept altering the positions of the four-way cocks on the triple valves, but all of no avail; releasing the engineer's valve would set either the driver or tender brakes, and by applying the brake with engineer's valve, some would release and others apply. We found that in placing handle on triple valve on left side in vertical position, all brakes operated very well, but but not satisfactory. Later on the blind gasket was placed in union where hose connects between engine and tender on left side, the handles on triple valves placed in horizontal position, small stop-cock to driver brake left open, and everything is now serene, with the exception of the pointers on the air gauge, which both indicate the same when brakes are not in use, when engineer's valve is in position while running. Now what we wish to know is, what is this pipe for, running on left-hand side to brake cylinder under tank, which we have cut out. You will notice that it runs direct from train pipe to tender brake cylinder, and the blind gasket was put in at small square indicated by arrow. Should the tee not have been put into the pipe leading from auxiliary reservoir and triple valve to driver brake, and run to the brake cylinder under tank, instead of intersecting the line it does? CHAS A SMITH.

Fireman Spokane Falls and Northern Ry

Spokane Falls, W T.



AIR-BRAKE PUZZLE.

[The conditions shown are new to us, and we can see no good reason for the arrangement. The extra pipe running from *A* to *B* is an innovation, it was evidently intended to tap the driver brake pipe at *C* so as to use that pressure for an emergency brake. The use of a stop-cock in pipe to drive-brake auxiliary is wrong in the start, as it cannot be used as an emergency brake, as the drum is not charged when cock is closed. Where the driver brake is used for emergencies only the driving brake cylinder should get its air from the auxiliary on tender or the stop-cock should be placed between the auxiliary drum and the brake cylinder as at *C*, so that the drum and triple valve will always be charged. We should recommend the removal of that extra pipe, as its hose is liable to wear or rot out and prevent the use of driving brakes; it is also in the way.

We can see but two reasons why the pointers of double air gauge should not show difference of pressures: the gauges may be wrong or the feed valve stuck *open* Remove the plug under the service stop notch, and look at this. It is encouraging to find locomotive firemen who grasp such subjects as this, and go to the bottom of it—want to know the reason why. We have ignored his modest request to use only his initials. Modesty keeps many bright men in the shade, while they ought to be out where the sun can shine on them.]

One of our subscribers, Clarkson Maynard, located away off at Nagpoor, C P., British India, writes us that he will soon send us some articles on the road service of the British-Indian Railways. There is now no country in the world having a line of railroad, where THE LOCOMOTIVE ENGINEER does not go—talk about your "long-felt wants," even the Chinese are crying for it!

All communications relating to the business of this paper should be addressed:

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Standing Notices.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

The Oldest Man.

The "oldest man" clause, for which the engineers fight so vigorously in every agreement made with the roads, is so manifestly unjust, and so plainly a damper on ability and merit, that it is a relief to see a clause such as the Wisconsin Central engineers have in their schedule, which reads:

"In promoting engineers to higher grades, the question of merit and competency for the service required must be considered paramount to age or rank." In regard to promotions:

"In making promotions, past record, competency and good habits shall take precedence over length of service, but any manifest case of injustice in promotion shall be subject to appeal by the Grievance Committee to the General Superintendent, and from him to the General Manager, if necessary."

The seniority rule is a combination of force to keep the ability of all the men in the service on a par with the poorest; if the "oldest men" are the best posted and most experienced engineers, they have nothing to fear from the younger ones. The only good thing the seniority rule does is to check the advancement of cousins and aunts, and other pet stock; but, after all, there is not much of this, and it could be easier cured for in some other way.

The seniority clause is a humiliating confession that those men who should, from their experience, be the best men in the service are afraid to stand a competitive examination—to be tested. There will be less of these clauses written in the future than in the past—and there ought to be.

John Livingston.

We have been repeatedly asked to help crucify Mr. John Livingston, alleged president of the Railway Shareholders' Association, who is making a howl about railroad men getting passes, and making considerable fuss one way or another—on paper. It has been discovered that this individual has sought passes from some of the roads himself, offered several radical remedies for strikes and strikers, offered to settle the Q trouble, and tell who hit Billie Patterson. If Mr. John Livingston is what he pretends to be, and is, indeed, a living thing in the shape of humanity, he is an egregious ass. We are inclined to think Mr. John Livingston is some stuffed stool-pigeon for a fool foundry, a detective agency, or a newspaper. Ten to one he is making his kick to get the labor press and the labor leaders on record with some very inflammatory and indiscreet language. Our advice to the enginemen of the country is to simply forget that such a mummy exists, do your duty to your employers—the company—your officers and yourselves, and rest assured that the management of the roads will see that your delegates get to the conventions and home again—as they always have.

Don't be so tender of your "rights" as to froth at the mouth because an outside cur snarls at your bone—he won't get it.

A Surface Condenser on Locomotives.

There are few railroad men who will not admit that we pay too little attention to protecting the steam chests and cylinders of our locomotives; they are practically uncovered and open to the cooling and condensing effects of our rigorous winters—a pretty good surface condenser. Perhaps there will be some light thrown upon this matter some day, and when there is we surmise that we will find one cause of the greater efficiency of English coal over ours—their chests are (as a usual thing) in the smoke arch and the cylinders under it.

We are pleased to note that Mr. Stevens, of the Lake Shore, is extending the lagging on cylinders clear around instead of only in front, and lagging the sides of steam chest. We want to see an engine tried with her whole saddle, cylinders and chests covered with mineral wool and cased in. We are of the opinion that such an arrangement would show a plain saving on any road in our 40-below districts. It is the pennies that make up the dollar, and it is the attention to details that make any machine an economical success.

A Great Work.

No other country on the globe supports such a costly and invaluable statistical publication as Poor's Manual of the Railroads of the United States. This work is issued annually at $6 per year, contains 1,700 pages numerous maps, and all the statistics and data that any person could desire about all the railroads in the country, a list of the officers, gauge of track, length, length of sidings, number of locomotives and cars, cost per mile, debt, interest paid, receipts, expenses, and a brief history of the road and its management.

The 22d annual number is about to issue from the press, and from the advance sheets we are enabled to give our readers a few figures showing the magnitude to which the railroad interests of the country have grown.

Railroading now has more invested capital and employs more men than any other industry or calling; this work estimates the number at 936,000 as actually employed on the roads, of course, this is not more than one-fifth of the people who live off the earnings of the roads.

We cull a few items of interest from among the thousands to be found between the covers of this great work.

The total number of miles of railroad in the United States at the close of 1888 was 156,082, of which 7,028 miles were constructed during the year—the rate of increase being 4.7 per cent.

The funded debts of all the lines at the close of the year aggregated $4,624,035,023, a sum of $437,091,907 in excess of the total of 1887.

The other forms of indebtedness of the several companies at the close of the year equaled $306,952,589, against $294,682,071 for 1887, the increase being $12,270,518. The total share capital and indebtedness of all kinds, of all the roads making returns, equaled at the close of the year $9,369,398,954.

The cost per mile of all the roads making return, as measured by the amount of their stocks and indebtedness, equaled very nearly $60,732.

The gross earnings or receipts of all the lines (including elevated roads) from which returns were received for the year, equaled $960,256,270, of which $251,356,167 were received from transportation of passengers; $639,200,723 from transportation of freight, and $69,699,380 from the transportation of mails and express matter, profits of leased lines, and other miscellaneous sources of revenue. In the latter sum are included the gross earnings of elevated railroads.

The gross earnings of all the lines for the year ending December 31, 1887, equaled $940,150,702, the increase for the year 1888 equaling $20,105,568, or 2.14 per cent.

The earnings per mile from which full returns were received in 1888 equaled $6,540.

The net earnings of all the lines for 1888 equaled $301,631,051.

The amount of interest paid in 1888 equaled $207,124,288.

The amount paid in dividends in 1888 equaled $80,243,041.

The number of persons transported in 1888 by all the lines was 451,353,655, against 428,225,513 for 1887, the increase for the year being 23,128,142.

The number of passengers carried one mile in 1888 equaled 11,190,613,679, against 10,570,306,710 for 1887.

The distance traveled by each passenger in 1888 equaled 24.78 miles; in 1887, 24.68 miles.

The amount received per passenger per mile equaled 2.246 cents in 1888, against 2.276 cents in 1887.

The number of tons of freight transported on our railroads in 1888 equaled 590,398,317, against 552,074,752 tons in 1887. The value of the tonnage moved in 1888, estimating its value at $25 the ton, equaled $14,633,957,925.

The number of tons transported one mile in 1888 equaled 70,423,005,988.

Engines on the "Soo" are fitted with a speed recorder, that not only publishes a record of speed run, same as the old Dutch clock, but also shows on a gauge in the cab the speed the locomotive is making at the time.

Cost of Air-Brakes.

We have before us a new pamphlet, just issued by the Westinghouse Air-Brake Co., in which they announce a great reduction in the price of their brake.

Formerly, it cost $300 to equip a locomotive, now it costs but $275. Passenger car equipment has come down from $138 to $100; freight car from $50 to $45.

Most of the prices for repairs have been greatly reduced; for instance, on air pumps, which have always sold at $200, a reduction of 37½ per cent. has been made, bringing them to $125; air hose coupling have cost $5, now they cost $2.50. We only hope that the reduction will serve to extend the field of this, the greatest of all safeguards to American train service.

There are invested in this brake in the United States alone, a capital of over $10,000,000, and this, by constant attention and repairs, is kept fully up to the original investment all the time.

The recent developments of the brake for freight service has made its use possible where it was impossible, and increased the efficiency of the device nearly 100 per cent. Before the invention of the quick-action triple valve, it took from 90 to 100 seconds to apply the brake to a full train of 50 cars—now they apply in *two* seconds. Before, there was an element of danger in handling long trains with the brake—now we can handle 50 cars as safely as ten.

A boiler maker with a great deal of experience tells us that it is his opinion that the cause of fire-box tube holes getting out of round is because it is the usual practice for boiler makers, in rolling leaky flues, to commence in the center, where they are the worst, and roll toward the corners, and in putting in new tubes it is customary to commence at the bottom and work up, each lower row of tubes springing the sheet a little until at the corners and top, stretching the metal enough to force the holes out of round.

ASKED & ANSWERED.

(37) C. H. R., Cape Girardeau, Can., writes:

According to my understanding of a theory, there is more pressure on the axle when crank is above it than below it. Pressure would be greatest on back of axle if engine was running forward, and on front of axle if running backward. Am I right or wrong? *A.*—We know of no practical reason why the weight or pressure on a locomotive axle should be different with the pin above or below the axle. In running ahead, of course, the axle pushes against the frame and draws the train, thus increasing pressure on the front of the axle, and in backing puts it on the back, for the same reason; practically, it would be very hard to find the difference in any of the cases stated.

(38) C. W. C., Toronto, Can., asks:

Will you kindly give me the diameter of the largest locomotive driving wheel that was ever made, and the fastest time the engine made. I think, if I am not mistaken, about a year ago there was a locomotive built in the old country with driving wheel 9 ft. 6 in., and made a distance of 80 miles in one hour. Also, largest size driving wheel on passenger engine that is running in America. *A.* The largest driving wheel we have heard of was the one of 10' 6", described on the first page of this paper for March last; there may have been larger ones built, but we do not know where. The largest wheel we know of in passenger service in America is six foot—years ago, the Camden & Amboy used to use eight-foot wheels.

(39) G. H. F., Springfield, Mass., writes:

Please tell me the most simple way to find out the horse-power of a steam boiler, and will you also please tell why they always use a curved link on a locomotive? Why could they not use a square link without any circle? *A.*—The horse-power of a boiler has always been an uncertain thing, without much uniformity of rule regarding it. The American Society of Mechanical Engineers have decided that the evaporation of 30 pounds of water per hour, under a pressure of 70 pounds, is equivalent to a horse-power, and is called a commercial horse-power. Links are curved in order to make the valve cut off equally when hooked up. Straight links are often used where the engine works at full stroke all the time, the office of the link being simply to reverse. The Allen link, much used on locomotives in Europe, is straight, but has compensating toggle joint in the stem that equalizes its cut-off.

IN THE ROUNDHOUSE AND REPAIR SHOP.

Editorial Correspondence.

WISCONSIN CENTRAL.

In his rounds for items of interest the writer headed for the Northwest early in the month, with designs upon the Wisconsin Central and the Northern Pacific.

The Wisconsin Central road runs from Chicago northwest, through the State of Wisconsin, to St. Paul, with a line from Abbotsford almost due north to Ashland, on Lake Superior, and another running south from Stevens Point to Portage, in all 775 miles. They have in service about 150 locomotives, and, having been bought and rebuilt under men of ability, they are not just like any engines you see any place.

The motive power is under the superintendence of John Player, but Mr. Player was in Europe, studying compound locomotives and compartment carriages, so I found the main shops at Waukesha in charge of General Foreman Alva Mitchell.

The Waukesha shops are entirely different from any other railroad shops I have ever visited. The boiler shop, smith shop, wood shop, foundries, etc., are each in separate buildings, especially well lighted, and so situated as to admit of their being enlarged without crowding other buildings, and the shops requiring the transfer of heavy pieces—like boilers—being across the transfer table from the main shops, while shops for light work, like the tin shop and brass foundry, are on the other side.

The main shop is a long, one-story building, built, as all the shops are, of white brick. In the front, and up a stair, are located the office of Superintendent of Motive Power, the General Foreman's office, drafting-rooms, etc. These rooms are lighted from the front, and the balcony in front of the doors overlooks the shop from an elevation of about twenty feet.

HANDY CRANES.

Standing at this end of the shop and looking down its length, we find on the right hand twelve stalls, each connected with the transfer table outside; over these stalls two huge traveling power cranes are hung. Either of these cranes can pick up a complete locomotive and carry it off, and they do all the "jacking up" there is to do. One of these cranes will pick up a boiler and set of frames complete, while the workmen roll the wheels away and place their blocks where they want the boiler and frame to stand.

Of course, such cranes as this have to be supported on heavy framing, and the heavy frames at the shop end of the big cranes serve to support one of the tracks for another set of traveling cranes of much smaller size and capacity. These cranes are strong enough to pick up any piece of a locomotive except the boiler, and driving wheels, frames, etc., are taken from the large open aisle back of the pits to any of the heavier machine tools, such as driving wheel lathes, slotters and the heavier planers and lathes, which are all arranged along this open aisle. Any man on these tools can pick up and place his work on his tool, and take it out and back alone.

Over the lighter tools another and a lighter set of traveling cranes are located, that will pick up and handle all light work to and from all the light tools. These two sets of cranes are handled by hand, and are located above the shafting, so that it is only necessary to avoid the belting with the load, and, as the tools are all arranged in rows, it leaves clear paths for handling work.

Every pit in the shop had an engine on it, and the shop seemed full of men, the machine shop is under the immediate charge of W. S. O'Brien.

In the roundhouse I stumbled on to traveling engineer R. McVicar, and found in him a progressive engineer who is proud of his profession, and desirous of seeing the engineers of the country place themselves upon a higher plane as skilled mechanics.

DESIGN OF LOCOMOTIVES.

The locomotives of this company are mostly 8-wheelers of modern build and design. On the sides of the extension fronts will be found no unsightly hand-hole plates to punch cinders through; the only hole provided for this purpose is under the number plate in the front door—the number plate coming off with the plug. This makes a neat arrangement, and provides all the poking facilities necessary.

The arrangement of check and branch pipes are peculiar on this road, and are spoken very highly of by all the enginemen we talked with. The check is a pipe check, and is located in the branch pipe close to the injector, or just outside of the cab, the pipe makes a gradual descent along the boiler, and turns down well in front where checks are usually located. Instead of a check, there is a globe valve here, and below it an elbow tapped into the boiler. By shutting down this globe valve the injector or check can be removed or repaired, and it is claimed that in the coldest weather—and they have 40 below there—that this pipe never freezes up, being open to the boiler, and without downward bends to form traps.

TRUCK BOX OILER.

They use a very neat and ingenious tender-brass and oil-box, designed, as was the branch pipe arrangement, by Mr. Barnes, a former master mechanic.

The brass nor the truck box have no oil-holes through them, but the brass has a recess cast in its top, with oil-ways running down to the edges of the brass, and between it and the box, on the inside of the box and above the axle, a hole is drilled in line with the axle to the center of the box, and there communicates with the oil-way on top of brass. To the side of box is bolted a square cast-iron box, holding about half a pint of oil, this is filled with wool, its cover bolted on, and a filling-hole left on top. On the side next the box, and near the bottom of the cup, a small copper pipe is screwed into oil-box, this pipe extends through the hole in side of axle-box when the cup is bolted to it, and delivers the oil to the recess in the brass. Thus the oil is always clean, there are no holes to stop up, and the oil is delivered to the axle as it goes under the brass, and not on top, where the load tends to keep the oil off the axle. This is one of the best devices for oiling trucks I have ever seen, it is clean, neat, and sure.

CINDER HOPPER.

The cinder hopper under arch is a large, straight pipe extending down toward center of track, it is closed by a taper plug entering it from below. Formerly this plug could be opened and closed from the cab, but now they are arranged to open by a lever worked from the ground, and held in place by a clamp and set screw. Designated places having been arranged as the only place where cinders should be dumped, the handy cab lever was taken away to prevent the boys being tempted to disobey orders.

The Newth ash-pan is used—the bottom formed of cast-iron slats like a window shutter, but these have also been arranged to dump only from the ground.

A recent fire at the Ashland roundhouse had sent four locomotives to this shop for new wood work and new paint, and illustrates the bad plan of keeping oil and storehouses near shops and roundhouses.

IMPROVED COAL BOARDS.

The coal boards are in the form of doors hung by heavy hinges at each side of the tank, and held together in the center by a heavy bar, the doors themselves being two-inch oak, heavily ironed. These coal boards are higher than the tank but have a good-sized arched opening at the bottom. They open in, or toward back of tank, cannot be lost or stolen, keep dusty coal from flying, and will hold back the coal from coming into cab in a considerable of a collision. They help complete the storm curtains in winter, a short curtain being used between back of cab and these doors, and curtains to the gangways beside the regular back curtain.

The transfer table has no propelling power at present, being designed for an electric motor that will soon be put in.

The shops are lighted by electricity throughout, an independent plant being provided for this purpose.

The tools are driven by a fine Brown automatic engine.

In going over this road we experienced our first train robbery, one man and a pair of revolvers got into our sleeper, and touched three men for their watches and money. The porter was active and noisy, and the robber, taking a shot at him, jumped off.

The Northern Pacific.

This great road reaches from the Mississippi River and the great lakes to the Pacific Ocean, and has 3,280 miles of road, and upwards of 500 locomotives.

The road is the busiest one in the Northwest, the freight men being run very hard, and every engine that will turn a wheel in service.

The general offices are at St. Paul, and in the office of Superintendent of Motive Power Small we found the neatest and best board for keeping track of engines we have ever seen, the board was designed by Chas. Craig, who was chief clerk of this department under Mr. Cushing.

It is laid off in small shelves about an inch deep and six or eight long, and is as high as a man can conveniently reach, and the top slightly inclined back. The districts of the road and the shops are arranged in vertical rows, and the engines designated by blocks of wood about one inch square and three long, these blocks have in large plain, red characters, the number of the engine, the rest of the data in smaller type and black, something like this:

259 **18 X 24 - 4 - 62**
N. Y. Locomotive Works. 1883.

This tells the number of the engine, size of cylinder, number of drivers and their size, the make and date of building.

To the right of this is placed a cube, on each face of which is printed one of the words, Pass., Freight, Switch, Good, Fair, Poor; thus, by using two of these is added the information what service employed in, and what condition of repair.

Mr. Small is having another set of blocks prepared that will tell whether provided with driver brakes, whistle signals, etc.

If engine 259 is in service on one division and is transferred to another, the set of blocks are placed under the column headed by that division's name; if she is reported in poor condition, the cube is turned from fair to poor; if she goes into a shop, her block is placed under that shop name.

The whole device occupies little room, is quickly changed, and tells a great deal.

The main shops of this company are located at Brainerd, in the northern part of Minnesota, but the coach shops are located near St. Paul, at Como.

I spent a very pleasant afternoon at these shops, but will be obliged to use what information I picked up there at another time, as I was after locomotive repair shops and locomotives themselves.

The road from St. Paul north is a dusty and sandy one, and I should say a very hard one on machinery. On the way up I rode on a locomotive equipped with Cushing's reverse lever, which was illustrated in this paper last year; it works very well, the engineer being able to set the lever in any position without disengaging it from the quadrant.

BRAINERD SHOPS.

At Brainerd we found extensive shops, substantially built of white brick, heated by steam, and fairly well equipped with tools and full of work.

The engines employed by this company are mostly moguls for freight and eight-wheelers for passenger, but the new passenger engines are heavy ten-wheelers.

As fast as they go into the shops they are relieved of the big stacks, known as the Cushing stack, and get straight stacks and extension fronts; the old stacks cost in the neighborhood of $65.00, and were very expensive to keep up—the extensions need very little repairs.

The Brainerd shops are under the management of Master Mechanic A. Bardsley, who has been with the road for a good many years. The shops are not so different from other shops as to need description, except that they are large and not crowded together; the pits in the main shop are arranged at one side as usual, and over them—or rather at the rear of them—is hung a light shaft especially arranged to use rope belting to drive cylinder borers, valve-seat facing machines, portable drills, etc. There is a small turn-table in the center of shop, big enough to turn a truck on.

SOME KINKS.

This road has lots of very bad water on the western divisions, causing much trouble with injectors. Mr. Bardsley takes the old style Monitors and cuts them in two just back of the overflow pipe and joins them with a large brass nipple; then they can be taken apart same as in the later style of Monitors with flanges.

The front end door is flattened in center to just the size of the number plate and turned true, the plate being laid flat against the door, this prevents the plate getting knocked off every time they strike a cow, but makes it a little harder to clean.

In the boiler shop they are cutting off the leg of fire box on a number of old moguls, and converting them into six-wheeled switch engines by placing the back axle under the box, and taking out the pony truck.

They use steam cylinder packing with adjustable bull ring, the center of bull ring being lightened by being cast with a recess inside.

All about the place are evidence of this company's fights with Jack Frost, snow-plows and flangers stand around in every vacant spot. There is everything from a board on a pilot to the steam rotary.

All the engines are provided with Jerome metallic packing for valve stems and pistons; it runs a year without attention.

We noticed in some new eccentric straps a large cellar is provided.

The new straight stacks are made of sheet steel and riveted fast to the stack saddle, no joint being provided between stack and saddle; this looks neat and gets the cost of stack and saddle down to less than $20.00.

Rocking grates are used with fingers 12 inches long and very large; we should think this would be a good plan, as it reduces the number of rockers, and consequently the number of connections.

The front ends are arranged with deflector ahead of the nozzle, substantially as shown some time ago in the D. L. & W. engines; single and double nozzles are used, preference being had for the double, the claim being that the engines steam better—I cannot understand this.

INGENIOUS BLACKSMITHING.

The blacksmith shop is under the charge of N. W. Wheatley, is large and well conducted. Side rods are here forged up so perfect that they are not finished at all except at the end for the strap; they are larger in the center than at the ends, the edges beveled, and look, when painted, just as good as a machined rod—indeed, I could not believe they were not until I examined them critically.

Mr. Wheatley is anxious to try his hand at fluted rods, and feels sure he can forge them to exact size.

Old tire is used up for tools, solid-ended wrenches for track and for engine use are made in dies and used without other finish, ball pene hammers are made of this steel for twenty cents each, and used without even grinding the face.

Springs are neatly got up, and we noticed that, instead of welding a strip upon the top leaf to keep the hanger from slipping toward the band, the leaf is turned over, and an oblong projection punched up that answers the same purpose, is neater and cheaper.

All the roundhouses of this company that we visited have a pit running around the house at back of pits, in which are located the water and steam pipes. I should think that in event of that common incident of an engine going against the back wall, that this pit would tend to increase the damage liable to be done; still it might simply serve to stop the engine and save the walls.

Extensive car shops are located here, the new saw and planing mill being the best one I have seen, every machine being thoroughly piped to an exhausting system that carries every bit of sawdust or shavings away, leaving a perfectly clean shop.

The main machine shops at Brainerd are under the care of general foreman H. Tomlinson.

The entire upper floor of the large office building is used for drawing rooms, M. M.'s office and library. The drafting rooms are under the care of O. H. Reynolds, who takes especial pride in his department of the business, and can turn to a drawing of any detail of any engine on the road in a moment.

The largest and most elaborate blue printing frame I have seen is here in use; the glass is about 8x4 feet, the prints turned out being very uniform and perfect.

A NEGLECTED OPPORTUNITY.

There is a very large library room here, with several cases well filled with books, all the principal periodicals of the country, and numerous drawing tables for students. While this is free to all employes of the company, we are sorry to have to record the fact that it is very little used; not a single apprentice is trying to learn drawing, and few books are taken home. It seems a shame that this library, with its hundreds of dollars worth of mechanical books, so eagerly hungered after by so many ambitious men in other places, here lies almost entirely idle.

FARGO.

Two hundred and seventy-seven miles west of St. Paul, and just over the Minnesota line in Dakota—North Dakota, if you please—is the busy little city of Fargo.

Fargo is division headquarters for several roads, but the Northern Pacific is the only one having any important shops here.

These are quite extensive, well built, nicely located, and the cleanest that I saw anywhere along the road.

They are under the management of master mechanic S. L. Bean, ably assisted by general foreman Wm. Hawser.

It was hot the day I spent at the shops, but twenty-two snow-plows standing in Indian file beside the roundhouse, bore mute evidence that the inhabitants of Fargo are not knee-deep in June all the year around.

INGENIOUS TOOLS.

Wm. Bretting, now in a similar position at Brainerd, was formerly foreman of tools here, and many evidences of his ingenuity are to be seen. One, a lathe attachment for turning solid cross-head pins, works nicely, despite the fact that it was made of such material as old hand-car gears.

A flue-hole cutter of ingenious design is here used, the knives being plain cutters held to the central arbor by a band shrunk around them.

A very handy kink of Mr. Bean's is a device for separating the valve stem from the rod when corroded fast. This consists of a clamp made to pinch the valve stem and a heavy fork to go over the stem and against the coupling or sleeve of the rod, these two clamps are held in place by two bolts, on which are loose nuts; the forcing apart of the clamps by turning the nuts breaks the joint.

A key-hole in the sleeve and behind the stem, prevents the necessity of such a device, but where there are no such holes the fits are often ruined by pounding.

This shop, like several others we noticed along the road, is continually threatened by fire from the proximity of an immense wooden coal chute.

In the shop the usual work was going on, but here and there little evidences of improvement show themselves. Division master mechanics on great systems like the N. P. have not got the opportunity to show their personal ideas that master mechanics on little roads have—they must keep within the standards.

A neat swing crane of home make has recently been put up, so as to cover a large floor space and the big wheel lathe.

Being a great country for sand and dust, Mr. Bean has recently made some experiments to keep dirt off the guides, by fastening a plate of sheet-iron on the back of the top of Laird guides, allowing it to extend below the lower one considerably; he has got rid of considerable of the dirt, which generally comes from between the tracks.

The Fargo shops, like all the others on the road, are heated by steam, and the ample display of heating surface in the pits and about the tools, bear evidence that the forty-below stories the boys tell are not all fairy tales.

CASE-HARDENING.

The blacksmith shop here is a very neat one for a small shop, and they do some of the nicest work in case-hardening links, etc., that I ever saw. The work comes out of the furnace clean and bright, without that scaly, scabby look so common; broken pieces showing a clean $\frac{1}{16}$ of hardened surface.

The plan followed originated in the shop, the result of some investigations by Mr Bean and the foreman. The receipt is as follows:

For an ordinary set of links and pins, take of salt, 15 pounds; sal-soda, 4 pounds; dissolve these in water. Then take of oxide of manganese, 1½ pounds; rosin pulverized, 1½ pounds, pulverized charcoal, 1½ pounds, these last three mixed together, then mix all the ingredients together and pack around the work in the box, being careful to have the pieces entirely surrounded with the compound. The addition of a few small limestones helps matters, but is not necessary.

Heat very slowly, or the cover of box will be blown off. A wood fire is considered best. Nine to twelve hours in the furnace does the work.

MANDAN.

A few miles west of Bismarck, and across the Missouri, lying between it and the Heart River, in an arid basin, lies Mandan, where are located the shops of the Missouri Division.

Mandan, like Fargo, is at one end of two engine districts under one master mechanic, so that one half the engines are not running where the M. M. can see them or they can easily get to the shops.

If the Fargo shops were at Jamestown, and Mandan shops at Dickinson, an improvement would be made, but, like lots of other things in a new country, they were built just where they are, and nobody seems to know why.

The Mandan shops are on about the same general plan of those at Fargo, being, however, a little further apart.

They had just lost 700 feet of coal chute, 3,500 tons of coal and twelve cars by fire; the chute was far enough away to save the shop.

The Mandan shops and the motive power of the Missouri division are under master mechanic J. E. Phelan, who is well known to the readers of this paper as the author of a popular series of air-brake articles.

The back shop is looked after by gen'l foreman T. W. McFarland, and the car department by J. F. Pilcher.

FROTHY WATER.

This division, 215 miles, has the worst water to contend with I have ever seen. Not so much in the scale-making line as in causing foaming; the water in the water glasses looks like sour milk.

It is very hard on the sheets and tubes, pitting, cutting and grooving them like acid.

All the engines have mud drums and blow-offs on them, surface blow-offs and the old stand-by on the water leg; these cocks are globe valves, and arranged to be handled from the running board when running; the men blow their engines out very thoroughly several times over the road, and every boiler on this division is washed out every hundred miles, even the switch engines at Dickinson get washed out every 24 hours.

Such water makes the expense of boiler repairs very high. The only thing found to stand the corroding effects is "Kalemein" flues, made of a peculiar white metal, but very expensive, a set costing from $600 to $800.

When I was there, this whole district was suffering from a water famine—many freight trains being obliged to wait at tanks for water.

DROP PIT.

Mr. Phelan has just completed a drop pit in his roundhouse that is designed to save lots of work, an old hydraulic jack with a broken flange will do the letting down and replacing act.

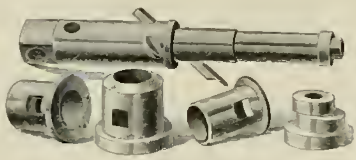
Most of the new passenger engines on this division are heavy ten wheelers of Baldwin make, with a wagon-top boiler having radial stays.

In the tool room I observed that one of the principal jobs was the renewing of tubes for injectors—Monitors being chiefly used.

In the boiler shop they are building a fair-sized lye vat, to cut the grease off work, such as used at the Renovo shops of the P. R. R.

WASHING HOT.

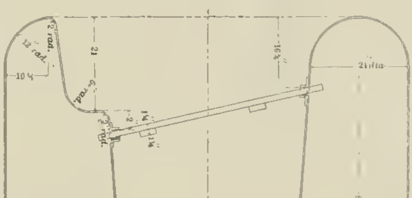
I was greatly surprised at the results here and at Dickinson, where they take engines with steel fireboxes to the house red hot off the road, knock out their fires, blow out, wash with cold water, fill up, fire up and have them ready for service inside of two hours, without a case of cracked sheets or other trouble from this cause. No doubt these engines would steam better and throw less smoke if they had brick arches, but the arch gets hot enough to warp sheets and melt out soft soft plugs, during the blowing out and washing periods.



VANCE TUBE CUTTER

Several feed-water heater and purifier men have been up there, met the enemy, and—are theirs. The Rushforth heater and circulator did just what was not wanted—stirred up the water from the bottom—it made the engine foam worse.

The Smith purifier, a pair of drums inside the boiler, designed to receive the deposits of impurities and keep them out of the boiler, did little better, there being no deposit of scale, but an excess of something that looks suspiciously like milk shake.



MORE ROOM IN THE TANK.

DICKINSON

Is something like a hundred miles west of Mandan at the entrance to the "bad lands," and is the center of Mr. Phelan's domain; there is here a small repair shop and large roundhouse, mostly new, steam-heated and in good shape. J. W. McQuay has just got off his locomotive to become general foreman here, and has considerable of a chance to clean house—and is getting there steadily.

The coal used in this country is good, but not the best. I noticed that every pile of cinders from the extension fronts was inclined to burn, not only themselves, but the ties and any pilots that might scoop up a handful of them. I should think that a cinder chute from the side of the arch, where the cinders are blown out with water, would be the thing for such coal and conditions.

J. A. H.

Vance Tube Cutter.

Last year we illustrated this tube cutter in its old form, but it has been so much changed and improved that it is, in fact, a new tool.

As will be seen, the cutter proper is all complete in the upper cut, ready to be used in cutting out tubes for that size, and by changing the sleeves shown below, and the washer on the end to keep the tool central, four different sized flues can be cut with the same tool.

The Vance cutter has no rollers or small parts to get out of repair, but is a heavy tool for hard service. The body of the tool is placed in the tube to be cut off, the knife placed in the inclined slot and driven through the tube, inside the sheet, and then the tool revolved one revolution, shearing off the tube and leaving so neat a finish as not to require scarfing to weld on safe ends.

This tool is made by the Vance Tube Cutter Co., Geneva, N. Y., who will furnish lists of upward of fifty roads using the device.

More Room for the Fireboy.

On this page will be found a new plan of water tank designed by W. T. Small, Supt. Motive Power N. P. Ry., for heavy consolidation locomotives.

When these big engines are provided with tenders in proportion to their size, the room to throw coal ten or eleven feet was too small; the gangway could not well be widened, for that meant longer wheel base, and if any longer, could not be turned on the tables in use.

Mr. Small got around the problem nicely, by taking a corner off the water leg on the fireman's side, and inclining the coal boards in such a way as to give more room on that side, and still store the same amount of coal.

Men who are trying to cover a ten-foot fire grate from a two-foot gangway, with an unused brake staff on the left side, which cannot be removed because it is "standard," will appreciate this kink.

The Greatest European Railroad.

At an after-dinner speech at Crewe, before the visiting American engineers, Mr. F. W. Webb, locomotive and car superintendent of the London & Northwestern Railway, stated the following: The company has a capital of $528,000,000; annual revenue, $51,700,000; and annual expenditure, $26,500,000. The number of persons employed by the company is 60,000; in locomotive department, 16,000; miles operated, 2,500; stations, 800; signal levers in use, 30,000; lamps lighted every night, 13,500; cabins, 1,400. The number of passengers carried annually is 57,000,000; weight of tickets issued, 50 tons; number of tons of goods and minerals carried, 36,000,000 annually; engine mileage per year, 55,525,334. Last month, with a mileage of 4,750,000, they had with the passenger trains only one hot crank-pin, and with the goods trains two such failures, and they had only one failure of a connecting rod for both goods and passenger trains. The number of tons of water consumed was 20,000 per day; coal used, 2,700 tons per day; pounds of water evaporated per pound of coal used, 7.45. During the year, beyond the ordinary services they had run 41,314 special passenger trains, 47,238 special goods trains, 78,285 special cattle and mineral trains; total, 166,832 trains. The company owns 58,000 freight cars, 5,600 passenger coaches, 3,200 horses, 3,100 carts, 2,500 locomotives and 20 steamships. Crewe engine works occupy 116 acres of ground, the covend area being 36 acres. While it may require an actual personal inspection of these lines and works to obtain a full realization of their dimensions, yet the above general statement and a comparison of it with some of our largest American railroads will show the extent of railroad operation under one management on a little island not much larger than New York State.—*Ry. Gazette.*

Questions and Answers for Engineers and Firemen.

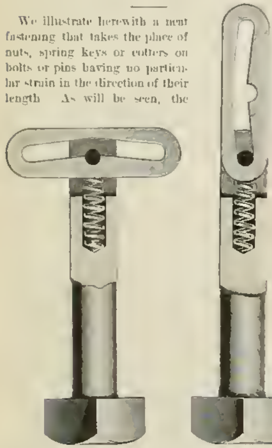
Geo. W. Cushing, Supt. Motive Power and Machinery of the U. P. Railroad, has prepared a book for distribution among his enginemen. It is in the form of examination questions and answers, and covers a wide range of subjects, including combustion, air-brake practice and break-down emergencies.

Anything and everything of this kind tend to the education of enginemen—if the enginemen only try to absorb some of the information thus offered.

The time is fast coming when engineers will be selected on competitive examination; how will you stand when that comes?

Wright's Bolt Fastening.

We illustrate herewith a neat fastening that takes the place of nuts, spring keys or cotters on bolts or pins having no particular strain in the direction of their length. As will be seen, the



fastening cannot become separated from the bolt, will go through any hole the bolt will, and stay in any position fixed by the tension of the spring. We should think this bolt would be particularly useful in brake rigging for cars and tenders.

It is made by the Wright Manuf'g Co., Phila., and sold by Pedrick & Ayer, of the same city.

Fairbanks & Co., of this city, have favored us with one of their new catalogues for 1889. This firm are the sole agents for the Handcock inspirator, of which there are probably more in use, in stationary practice, than all other forms of injectors combined. This firm have recently placed on the market a very complete line of brass and iron plug cocks packed with asbestos; if they can make a plug-cock that can be used for a blow-off for locomotives, and that won't stick, shut or open, and will let a man get within forty feet of it after it has blown five minutes, they will have made themselves immortal to the railroad men of the country.

It is estimated that the presence of $\frac{1}{16}$ inch of scale causes a loss of 13 per cent. of fuel; $\frac{1}{4}$ of inch, 38 per cent., and $\frac{1}{2}$ of an inch of scale, 60 per cent. The Railway Master Mechanics' Association of the U. S. estimate that the loss of fuel, extra repairs, etc., due to incrustation, amounts to an average of $750 for every locomotive in the Western and Middle States.—*Exchange.*

On the N. P. road and the Wis. Central we observe the use of an intermediate check valve about midway in the length of the branch pipe, the line check being dispensed with. On the Wis. Central the branch pipe has a globe valve next the boiler, in place usually occupied by check, and the pipe bends up from this instead of down, as is the usual practice; this leaves no trap for water to freeze in, as the the check in pipe is well back next injector.

On the N. P. road, as soon as a passenger train arrives at a station where engines are changed, the car repairers—galvanizers—put out a blue signal flag or lamp on a post provided for that purpose, and then proceed to inspect the wheels and running gear of the the trains; when they are through the signal is removed, and a gong rung, to signify that they are through, and the train can be moved without danger to them.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. X. | NEW YORK, OCTOBER, 1889. | 1.00 per Year or 10c. a copy.

A Modern Passenger Locomotive.

Historical locomotives are interesting, and it is not the purpose of the paper to abandon the series, but to continue them a little more thoroughly mixed up with modern practice.

The subject of the accompanying engraving is a first-class modern passenger locomotive recently built by the Rhode Island Locomotive Works for the Cincinnati, New Orleans & Texas Pacific. Gauge, 4' 8½". Fuel, bituminous coal. The drawings are complete, just as made by the works to build the engine to, and below are the complete specifications, so that our readers who are not as familiar with building as they are with repairing, running or firing, may see just how the new locomotive is planned and got out.

TUBES

231 2" O. D., 10' 7" long. Material, Franklinite steel No. 12, B. W. G. copper ferrules at fire box end. Placed 2.7" centers in vertical rows 2⅛" apart.

CYLINDERS

18"x24", exhaust ports, 17"x2¾", steam ports, 17"x1½" (1 13-16" at seat). Allen Richardson valves. Lap inside, 0", lap outside, 1 3-16"; travel (full), 6¼"; maximum cut-off, 20½"; minimum cut-off, 1½". Lagged with asbestos.

CONNECTING RODS

Best mild steel; main rod solid, fork end on back; parallel rod solid ends, made extra deep in center of rod. Oil cups, R. I. L. W., needle index cups of large size, and cellars.

CRANK PINS

Best hammered iron, case-hardened and ground. Sizes, main, 5½" diameter x5"; parallel, 5" diameter x3½".

SMOKE-STACK

R. I. L. W. style; taper inside from 15¼" to 18"; jacketed by an air space; height from smoke-box, 50"; total height from track, 14' 2⅛".

THROTTLE

Balanced type, wrought iron dry pipe; all steam ducts from boiler to cylinder made ample for high piston speed.

WHEEL BASE.

Driving, 9' 1". Engine, 23' 2". Engine and tender 44' 8½".

TENDER.

TANK.

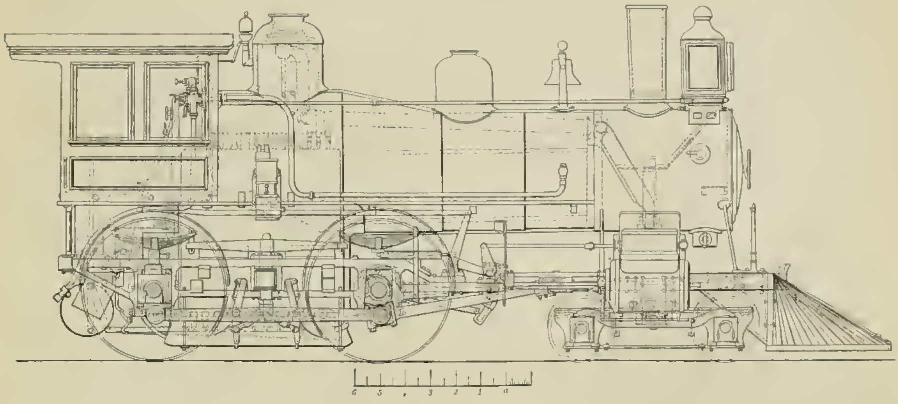
Tank iron, all plates ¼" thick; capacity, 3,500 gallons water; 4 tons coal of 2,240 pounds.

FRAME.

Oak, 12" deep, strongly braced.

TRUCKS.

Two 4-wheeled center bearing with side bearings on back truck; wood bolsters supported on 4 full elliptic springs.



BOILER.

Wagon top with deep fire-box and extension arch. Material, best Shoenberger steel, ½" thick; throat sheet, ⅝" thick. Waist, 56" diameter at first course. Seams, double-riveted circumferential seams, double riveted with welt strips on long seams. Designed to carry 170 pounds. Back head of boiler made a perfect circle, the top and sides of wagon top made of one sheet. Boiler lagged with asbestos plaster.

FIRE-BOX.

Material, best Shoenberger fire-box steel. Crown, ⅜"; back, ⅜"; sides, 5-16", and tube sheet, ½" thick. Size at ring, 78⅛"x35⅝". Water space, 3" at sides, 3½" at front and back. Crown bars, 6½"x¾", placed 4¼" spaces; ends forged on bar. Stays, ⅞"x1"; four top rows drilled ½" deep from outside to detect breakage. Furnished with fire-brick arch supported on four water tubes. Fire door, 16"x18", R. I. L. W. special door with adjustable inlet and steel deflecting plate for air.

HEATING SURFACE.

Fire-box crown	29	square feet.
Vertical surfaces	128	" "
Tubes	1,315	" "
Total	1,472	square feet
Flue area	4.14	
Grate area	19.19	

CROSSHEAD.

Four-bar type of cast-steel, brass bearings top and bottom.

DRIVING WHEELS

68" diameter, Krupp crucible steel tires, 3" thick, both pairs flanged. Total play on track, ¾".

DRIVING AXLE

Best hammered iron. Journals 7½"x8".

ENGINE TRUCK

4-wheel, rigid center, wrought-iron. Wheels, Krupp No. 1 crucible steel. Tires, 30" diameter.

FRAMES

Sizes, main frame, top rail, 3½"x4"; main frame, bottom rail, 3½"x3"; front rail, 3½"x1½"; over pedestal jaws, 3½"x5". Pedestal jaws held at bottom by thimbles and 1¼" bolts, all braces welded on.

GRATE

Rocking bars with dump plate front, fitted with suitable rocking levers, latches, etc.

GUIDES

Of best cast-iron, 4-bar pattern. Top guides, each 4" wide x2½" thick; bottom guides, each 3" wide, angle section.

PISTON.

Solid type, with spring ring packing, rod 3" diameter, of best steel, pressed into piston, and held by nut.

WHEELS.

Double-plate chilled, 30" diameter. Tender furnished with 3 tool boxes; coal space floor of iron; 2 brass tank cocks, strainers, etc.; safety chains front of each truck; Westinghouse air-brake on both trucks, with Meehan-Ross shoes.

GENERAL FEATURES OF APPLIANCES.

BRAKE.

Westinghouse automatic, class Z, for drivers, tender and train, with Meehan-Ross shoes all around.

PACKING.

U. S. metallic on piston-rod and valve stem.

FEED-WATER.

2 Monitor injectors, No. 8 R. H. and No. 9 L. H. Copper piping all around.

COMBINATION STAND.

Brass, R. I. L. W. type, placed in cab, containing an automatic closing valve in case of breakage. This stand contains all starting, blower, heating, steam lubricating, bell ringer, etc., valves, thereby saving numerous holes in boiler sheet.

LUBRICATOR.

Nathan double-sight feed for cylinders and single feed for air pump.

SAFETY VALVES.

Two 2½" Crosby encased pop valves.

WEIGHT.

Engine in running order (2 gauges water)..	102,000	pounds
Drivers " " " "	66,000	"
Truck " " " "	36,000	"
Engine and tender in running order (2 gauges water) .	172,000	"
Tender in running order . .	. 70,000	"

TRACTIVE POWER

Per 1 pound M E P on piston = 114 4 pounds Adhesive weight on drivers estimated at 22% ($\frac{1}{4\frac{1}{2}}$ about) of absolute weight is 14,530 pounds. Using 160 pounds as initial pressure in cylinder, the point of cut-off making the treative power equal the above adhesive weight, is 7-16 stroke

To an inquiry about the service this engine was performing, Mr. Meehan, Supt. of M. P. & M., courteously replies as follows

Editor The Locomotive Engineer:

Replying to your favor, inquiring about service of engine 85, would inform you that this engine is in express passenger service between Cincinnati and Somerset The time and number of cars varies per train, and, owing to the heavy grades and curves on our line, I am in doubt if I could give you any information that would appear favorable, compared with the record of other engines of this class on other roads. I will, however, say that on trains 1 and 2, the engine pulls from five to seven cars, being composed of one baggage, one mail, two coaches and the remainder Pullman sleepers. Trains 5 and 8 contain from ten to twelve cars, made up of one baggage, one mail, one express, two coaches and the remainder Pullman sleepers. The distance of the trip is 158 miles, and the schedule is as follows: No. 1, 4.40; No. 2, 4 50; No. 5, 5.40; No. 8, 5.15; making an average respectively of 33.9, 32 7, 27.9 and 30.1 miles per hour. This includes several stops, and, by allowing for these, I find that the speed would be as follows: No. 1, 40.9, No. 2, 43.9; No. 5, 36.5, No. 8, 40 3. The engine consumes 55 lbs. of coal per engine mile, and considering the fact that we have 60 feet grades, and 6 degree curves, I consider this performance equal to others in similar service.

I trust the above will enable you to make some kind of report on the engine, but if not, I shall be pleased to give you any information that you desire thereon, if you will state specifically what you require.

JAMES MEEHAN, S. M. P & M.

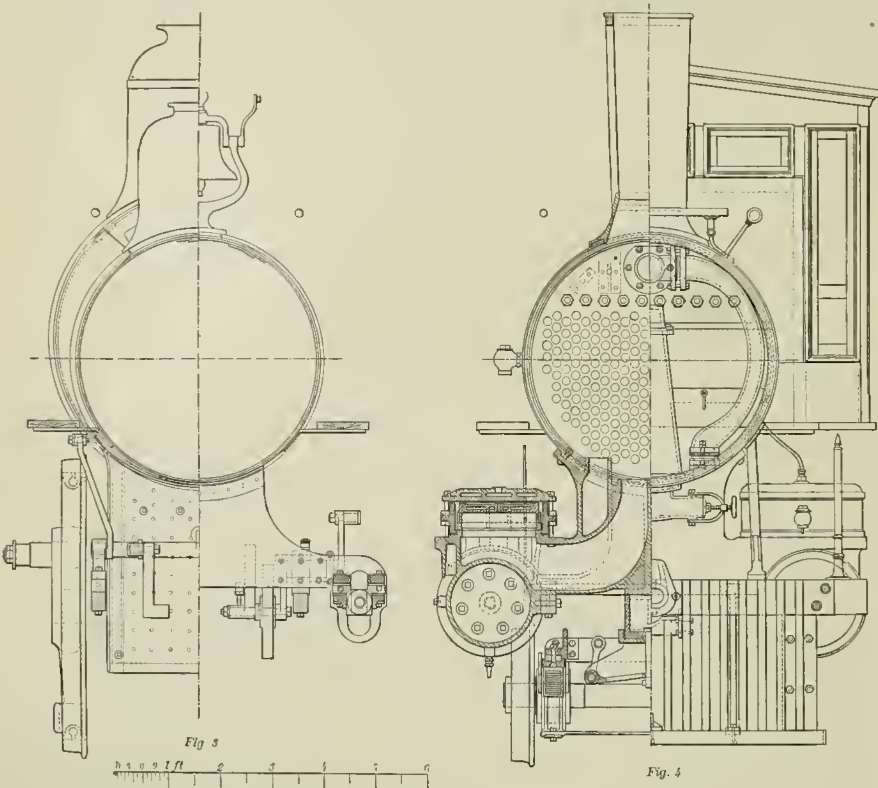


Fig 3

Fig. 4

Half Section Detail, Looking Back *Half Section Through Guides, Looking Back* *Half Section Through Cylinder.* *Half Front View*

The Traveling Engineer.

BY J. E. PHELAN.

SECOND PAPER.

The main duty generally attributed to a traveling engineer is that of educating engineers and firemen to proper performance of duty, *i. e.*, looking after the competent handling and care of engines in service. Herein lies a principle that should never be lost sight of.

Time was when running an engine was in an experimental stage—when it was supposed that a locomotive engineer possessed ability gained by some mysterious hocus pocus not known to the ordinary mind. At that time it was customary to throw out a string into the atmosphere somewhere, baited with a piece of liver, to catch the first specimen hungry for a job.

Such specimens once employed, it was necessary to have a traveling engineer to give information concerning which way the lazy cock went on and off, and when the water reached the top of the stack. Such and various other important points of necessity had to be imparted to the specimens.

Time was when the main qualification necessary to secure a position as locomotive engineer was the possession of gall enough to claim experience, with nerve enough to depend on the traveling engineer firemen or head brakeman to impart desired information, after position once gained and name on the pay-roll.

At that time trains ran tri-weekly, and an individual could find time to get around at an ordinary way station, and have some friend—foreman or otherwise—walk him around a ten-acre lot to sober him up—when the trip continued would reach the terminal on time.

This is not a fancy sketch, but simply places quiet facts in cold type.

The time has come, with railroads developed into giant systems, when it takes a clear brain in a well-shaped head to successfully manage a locomotive.

Large systems must be managed economically to be profitable. "The revenue of transportation is earned in movement of trains, hence the proper condition of engines to perform this duty to a maximum capacity is of first importance."

It is a self-evident fact that a competent and reliable engineer is a prime necessity in securing duty of engines to a maximum capacity at least cost consistent with such duty.

If it is supposed that a traveling engineer, by sitting on an engine, and looking wise, or, on the other hand, talking like a poll parrot to a native, can impart brains and ability to an engineer in charge, the one who supposes such grand transformation possible, has more imagination than common sense.

It has been said that good engineers are born, not made—the same can be said regarding traveling engineers.

A man who will draw pay as an engineer, and expect a traveling engineer to come along and tell him what to do, or how to do it, is lacking in the necessary qualifications for success.

The plain duty of a traveling engineer is to see that engines are kept in proper repair and in good condition for maximum duty. Also to see that engineers and firemen do duty for which they are employed.

If an engineer or fireman, through lack of opportunity, fails to know or practice correct principles, the traveling engineer must do his part in giving necessary advice and instructions.

If the traveling engineer should be asked a question, and necessary knowledge not at hand for answering, he should not look wise, and play bluff, but look up the desired information, and when found, later, make proper statement, giving and gaining proper and profitable information.

We claim that it is the duty of engineers and firemen to seek information regarding proper performance of duty.

We claim that it is not the duty of a traveling engineer to knock information into minds not having energy enough to seek what may be needed.

The traveling engineer should not run a mental coffee-house to furnish grub and potion to devil-may-care individuals.

The traveling engineer should be in position and fully equipped to help those who help themselves.

Everything consistent with proper methods, should be done by the traveling engineer, to assist engineers or firemen in the proper performance of duty, before condemning any one as incompetent.

The occasional subject with swelled head, fully graduated in all that is knowable, yet persisting in practicing incompetent methods, should be handled without gloves.

One field the traveling engineer can always find open for action, and study, *i. e.*, embracing the introduction and application of new devices or improvements on appliances in use. In such field the traveling engineer should be a pioneer, fully mastering details, and always standing ready to impart reliable instructions concerning the same.

Found the Trouble at Last.

There is no such a thing as comfort, satisfaction or peace of mind on a locomotive that will not steam freely.

Both men will get hot the first time they miss a meeting point or stall, and are so out of sorts with everything and everybody, that they care very little what else happens. The writer used to fire for a man who was usually in possession of a poor steamer. He was a pretty good runner, as runners go, but he had an eternal itching to get in the front end, and "make her steam"; as a consequence, she was subject to congestive chills. It was not so comical then as it seems now, the ways old Gorman had of getting even with her. The engine was named San Pedro, numbered 37; Gorman, being an expert handler of profanity, took most of his spite out in swearing: when the 37 would lean up against a hill, and then lay down, Gorman would leave her wide open, start the blower, and get off and sit down beside the track, remarking, among the oaths, "Salt Peter, 37 degrees below zero; I wish lightning would strike her this minute, and weld her to the track!"

Another time, when reminded that there was a pin or tank-box getting hot, he would make no efforts to relieve it, simply saying, "Thank the Lord there's *something* hot."

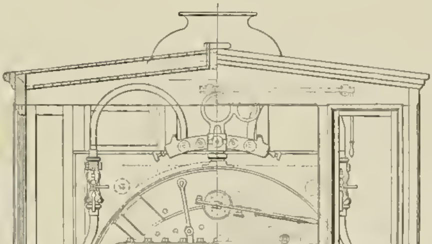
Gorman laid off for ten days once, and a young runner split her nozzles, got a smaller draught-pipe, and made her steam very freely. When Gorman got back, the first trip he was surprised to hear her pop at every mile-post.

"Sonny," said he, turning to the writer, "did that young feller go monkeying in her front end?"

"He did, and she steams immense," said the scoop artist. Gorman lapsed into silence for half an hour. "Sonny," remarked Gorman, with a twinkle in his eye, as he got off at the terminal station, "Sonny, you take her up to the house, and get the boss boiler maker to take out them bolts in the front door, and put in rivets, and head 'em down, fix her so's I can't get in there noway."

The Young Men's Institute, at 222 and 224 Bowery, this city, furnish a good deal of amusement and instruction for a very small amount of money. The full arrangement has just been announced, and includes evening classes in drawing, both free hand and mechanical, and also classes in arithmetic and steam engineering. For a very few dollars per year a young man may enjoy not only these privileges, but those of the library, the gymnasium, the bath rooms, etc. Young railroad men with leisure on their hands, when in the city, will find time and money expended in this direction but bread cast upon the waters, that will return after many days.

Outline of Valve Motion.



Half Section Between Drivers Looking Ahead. *Fig. 2* *Half Back View*

H. M. T., of Philadelphia, sends us a sketch of a car coupler on the plan of the Miller hook, except that the draw-bar is pivoted at the end of car, in place of as near the center pin of truck as possible, asking our opinion of the device. It will not couple on a curve, and will uncouple under the same circumstances. Practically the same device has been tried and abandoned many years ago.

Taunton, once famous as a locomotive building center, is doing nothing at all in that line now.

Changes in Design of Class "P" Engines of the P. R. R.

The Pennsylvania road have recently turned out some new class "P" engines from the Altoona shops.

The new engines are somewhat changed from the former style of the same class; some of the changes being improvements, others being very doubtful.

The old class "Ps" had 54″ boilers, the new have 62″—an improvement—the cylinders in each case being 18½ x 24.

The new engines have heavier frames and improved spring hanger arrangements.

The fire-box is of the Belpaire style, with the dome setting in the center of boiler, ahead of the wagon-top, and is covered by a plain, smooth casing, English style, rounded entirely over; nothing in dome but throttle.

On the wagon-top, just ahead of the cab, there is an oblong casting, something like the safety valve casing on the Webb engine; this carries the pops and the whistle.

The cab is perfectly plain outside, no panels, beading, cornices or gewgaws—an improvement—it is small and very low, has no ventilator on the roof, and a seat from which a man cannot reach anything—not an improvement.

The square top of Belpaire form of wagon-top fills the cab very full; makes it hot and crowded.

The throttle lever is so set that it carries the runner's wrist over a brass plate or plug, that is always hot—not an improvement.

The throttle stem is in the end of boiler, a cross-piece lever and extra rod run from it around and on top of boiler to the throttle lever—extra pieces—the gland is within six inches of the back partition of the cab, making a very unhandy thing to pack—not an improvement.

They have got the engineer's brake valve high up and clear back on the corner of the wagon-top—unhandy to reach and disagreeable to handle.

They have done away with gauge cocks and use two water glasses, placing them on the boiler head—behind the engineer, the runner must turn around and lean back to the end of cab to see them—a dangerous thing on a road like the P. R. R., where men must watch signals very closely.

On both the engine and tender the large wooden steps are used, such as are common in England.

On the tank head next the gangway there are two rods on each side, that extend from the deck to top of tank for hand holds. On the cab a large rod runs from the bracket to top of cab—a great improvement on our little, dangerous and slippery steps and handles.

There is a Sellers injector on the right side and a Monitor on the left—the piper seemingly trying to see how many bends he could get in the polished copper pipes.

These locomotives, seven in number, now on the N. Y. division, were all equipped with balancing plates, for their Allen-Richardson valves, that were suspended from the chest cover from a single connection at the center. All of these plates broke loose in the first few trips, and they are being repaired by putting in plates held by bolts in the usual way.

The number of passenger journeys taken in Great Britain in 1888—exclusive of season ticket holders and commutation journeys—was 742,830,000. During the year there were 905 people killed and 3,826 injured; this is only one killed out of 6,942,336 carried, and only one injured for 527,577 carried—including passengers and employes.

Improving Sand Pipes.

On the E. T., V. & G. they have, in a great measure, done away with the trouble caused by damp sand collecting in the lower end of sand pipes, by putting a **T** in the pipe above the running board, and connecting an elbow and nipple to it, simply turning the latter down.

This, it is said, allows of a circulation in the pipe, and prevents the gathering of moisture in the lower end. If it does, it also prevents a lot of soft hammer profanity.

Indicating Locomotives.

By Cyrus F. Richmond.

FOURTH PAPER.

The card shown in August issue of The Locomotive Engineer was a very easy one to obtain mean effective pressure from, for the reason that it was so regular in form. The nearer it approaches to a rectangular shape, the easier it is to work up. But in indicating locomotives one will find all sorts of shaped cards, and it requires patience and good judgment to work up the cards correctly without the use of a planimeter. Too much pains cannot be taken—the habit of saying, "That is near enough" will not do at all in this case. "Near enough," if not handled with care, would make a test of value only as a curiosity. So, in laying out the ordinates and locating the points at the end of each, it is quite essential to use a hard pencil, and make as fine lines and points as possible. It will also be necessary to use great caution in measuring the lines, and for that reason it was stated in last paper that a scale must be used that corresponds to number of spring that was used in indicator, and I still believe it *necessary* for a beginner to use said scale, and then it will not be so easy to make mistakes. The method suggested by Mr. F. M. James is correct, and he admits the above correct, and it is generally believed to be the safest method for beginners, surely it requires less calculating, consequently less chance for errors.

Fig. 4 is a copy of a locomotive diagram quite common in form for high speed and early cut-off, and, it will be noticed, of somewhat irregular shape, and not so easy to obtain mean effective pressure from as those that approach nearer the rectangular form. After laying off the ordinates, a little study is required to arrange the diagram into a more regular form for measuring the ordinates.

We have added the part *a* shown by dotted lines, and discarded the part *b*, thus making about an equal exchange of area, and obtaining a more regular shape. Similar changes have been made with *c* and *d*, also *e* and *f*. Now it could be made still better by changing more of the irregular lines, exchanging area where convenient. This requires some practice as well as good judgment; but after a few cards have been worked up in this manner the changes will readily occur to one, and the eye will soon become trained to exchange areas with exactness. We do not advocate this method as being absolutely correct, but believe it to be practically so.

We have now introduced the subject of indicating locomotives, and have tried to explain the reading of cards and methods of determining mean effective pressure from them, which was as far as was intended to carry the subject in these papers. There yet remains a great deal more to be said, but believe it would not be interesting to those who have had no experience with indicators.

Now it may be asked, of what value is such a subject to engineers and firemen, whose only business is to get over the road on time, and bring the engine in with her full complement of drivers, rods, levers, etc? To that I would answer: Stop calling yourself engineer until you are willing to spend a little time investigating the "mysteriousness" going on in the cylinder, when you are gliding along at a fifty-mile gait. Is it not a valuable, as well as interesting fact, to know the power a locomotive develops at various speeds, and the best methods of obtaining its greatest power with the least consumption of coal?

Fig. 5, which, like 6 and 7, is reduced one-third in size, shows a very poor handling of throttle and reverse lever, which, if practiced to any extent, would be one way to exhaust the coal mines, and make the poor fireman's back ache. It will be noticed that the boiler pressure is 125 lbs., while the initial or pressure in cylinder at beginning of stroke is only 56 lbs. for one end, and 57 for the other, and the steam is admitted for twelve inches of the stroke.

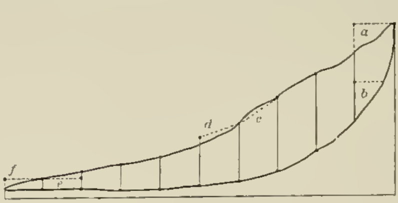


Fig. 4

The cause for such a low pressure in the cylinder in this case was mainly due to a partly closed throttle, which "wire-draws" the steam, that is, expending its force in trying to get through a small opening. We think it would have been better—if it was desired to "hold her in"—to pull up the reverse lever, say to 6-inch notch, and open the throttle wider, thereby getting nearer boiler

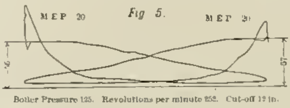


Fig. 5.

Boiler Pressure 125. Revolutions per minute 252. Cut-off 12 in.

pressure in cylinder at beginning of stroke, and allowing a greater expansion of the steam.

Fig. 6 shows a much better handling of engine, running at same speed precisely, there it will be noticed boiler pressure is 145 lbs., and initial pressure 125 lbs., which is a loss of but 20 lbs., or rather within 20 lbs. of boiler pressure.

This card shows what is called "initial expan-

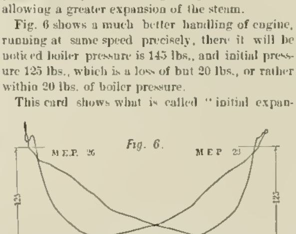


Fig. 6.

Boiler Pressure 145. Revolutions per minute 252. Cut-off 6 in.

sion," which means a falling of pressure in cylinder before steam is entirely cut off, and is caused by the gradual closing of port common to any slide valve—the cut-off taking place when piston has traveled but six inches, and the widest port opening is had when piston has traveled but one inch of its stroke.

Fig. 7 shows a card that was taken when running

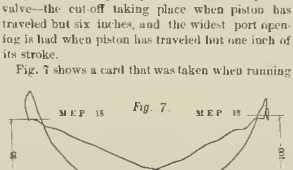


Fig. 7.

Boiler Pressure 113. Revolutions per minute 312. Cut off 8 in.

at more than a mile a minute, with a boiler pressure of 113 lbs., and initial pressure at one end 100 lbs., and 95 lbs. at the other, and shows good handling of engine. And so I might run on and pass judgment on indicator cards before me—that were all taken from a locomotive—for a day, and they would fill up one issue of the paper, but I believe the subject is now being well presented by various writers, and my hopes will be realized if the few papers by the writer have furnished some students with food for thought, and will start them in the right direction for progress.

Elementary Lessons on First Principles.

FIRST LESSON.

It is not the purpose of these articles to instruct old students of steam engineering, but to present in the plainest possible language clear explanations of some of the first principles that are not understood by the average of young men in our shops or upon our locomotives.

Most of the books upon these subjects are too deep for men not well up in the higher mathematics, or the subjects are enveloped in a shroud of mysterious motion curves that frighten off our too timid students.

Engineers and firemen, as well as the average railroad mechanic, are familiar with many features of the locomotive as a whole or in detail, know that they must be so and so, but, asked to give the reason—the why and the what—and they are lost; they are like the savage that knows that for a time the sun has hid her face, but what caused the eclipse is, to him, a mystery.

Suppose we commence lesson number one with the

ANGULARITY OF THE CONNECTING ROD.

What is known as the angularity of the rod affects the motion of the piston, and makes it necessary to change the motion of the valve to correspond to the irregular motion of the piston.

Let us look up the why. On page 3 is an outline sketch of the crank-pin path, main rod and piston. Now it is perfectly plain that when the crank-pin is at 1 or at 4 the piston will be at *D* or *C*, the extreme end of the cylinder. As the piston and crosshead are keyed solidly together, we will consider only the motion of one, as in this case their motions are exactly the same. The angularity of the rod always decreases by increasing the length of rod; so in this case we show the rod but half the usual length, as compared to the proportions of other parts; this will serve to show the effect of angularity more plainly. Now, suppose we start the pin from 1 in the direction of the arrow, at 2 the crank has traveled over one-quarter of its path, or 90° of the circle, but the piston has failed to get to the center of the cylinder, and is at the point* marked *A*, and not until the pin reaches point 3 does the piston complete half its stroke, and arrive at *B*—the pin has made more than half its extreme travel back and forth, but the piston has got behind.

This is because of the angularity of the rod; if it reached from the point 2 to the point *B*, it would have to be longer. Let us follow it and see what becomes of the uneven motions, from 3 to 4 the crank travels less than a quarter revolution, but the piston reaches the dead center at *C* at the very moment the crank gets to 4—it has caught up.

Let us see *why*. Remember that when the pin is at 1 and 4, the rod is in line with the center line of the cylinders, and not at an angle to them, and that its angularity is constantly changing in degree, becoming *more* as it goes away from the dead points at 1 and 4, and *less* as it approaches them.

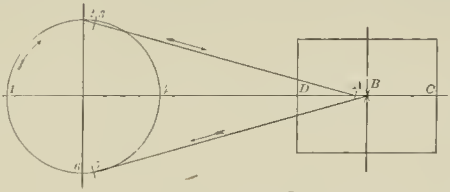
Let us follow the piston back from *C* to the center of the cylinder at *B*. You will see that the pin has only got to 5; the constantly increasing angularity has made the piston travel a full half stroke before the pin has got to the quarter; the piston reaches *A* again when the pin gets to 6, the quarter, but the moment the pin gets past 6 the angularity of the rod commences to decrease till it reaches 1 again, which it does by the time the piston is at the end of the cylinder at *D*.

Now, you see, the pin has to travel from 5 clear around to 3, in order to make the piston go from the center of the cylinder to the back head and to the center again, while it only has to go from 3 to 5—a considerable shorter distance—to make the piston go from the center of the cylinder to the front at *C*, and back to the center. Something is working unevenly. What is it?

The fly-wheel, in a stationary, and the moving weight of engine and train in a locomotive, act as governors that prevent uneven impulses given to the pistons from affecting the regular rotary motion of the crank pin, and, as that is coupled to the piston by the main rod, the result is that the pistons travel unevenly; not only do they stop and start at each end of the stroke, but they make one-half their journey quicker than they do the other half. In a full revolution of the crank the piston will always travel the *least* while the crank is making the half revolution furthest from the piston, and travel the *most* while making the half revolution nearest the piston.

In locomotive practice it is customary to place the center line of cylinders slightly above the center line of the wheels, and this increases the angularity on the lower half of the crank-pin's path, and decreases it in the upper half, but this change is so slight that locomotive builders, as a rule, ignore it.

The motion of the valves of a locomotive are derived from eccentrics fixed upon the axle, and coincide more nearly with the motion of the main pin than the piston, so that something must be done with the valves to equalize the point of cut-off for the uneven motion of the pistons. In the ordinary link motion this is done by changing the point of suspension, or saddle-pin, of the links, upon which the next lesson will treat.



ELEMENTARY LESSONS ON FIRST PRINCIPLES.

An Improved Throttle Latch

In the issue for June last we published a drawing of the very efficient throttle lever latch designed by Mr. R. D Wade, Superintendent M P of the R. & D. road.

Since that time Mr. Wade has made a decided improvement in the device, that prevents the throttle being accidentally opened, or from flying open when once pushed shut, whether screwed down or not.

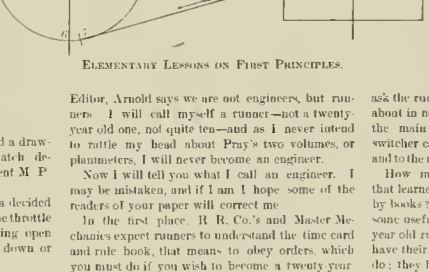
As will be seen, the throttle lever contains a screw that is forced down upon a sector, to hold the throttle in any given position, no notches being used, the device can be adjusted to the very place wanted.

The improvement consists of a single notch in the sector, in proper position to hold the throttle closed. On the end of the screw is a loose collar, forced down by a spiral spring; the moment the lever is shoved forward this collar snaps into the notch, and secures the lever against accidental opening

The collar is prevented from coming off the end of the screw by a pin through the end of screw and a slot in the collar.

In order to move the throttle out of the closed position, it is necessary to turn the handle—and thus the screw—three full turns; this lifts the collar clear of the notch. The handle is then screwed down so as to grip the sector, by a very slight turn to the handle.

This arrangement makes the neatest and safest throttle we have ever seen.



IMPROVED THROTTLE LEVER.

The B. & O have been trying coke as fuel on some of their passenger engines, with fair results. Coke is used considerably in England for suburban work, and is a very desirable fuel, it is so clean, throwing little smoke or cinders. Baldwin's have lately delivered 12 engines to the road especially designed to burn coke.

Look over the questions and answers in another column, and if you think you can suggest changes that are improvements, or see statements that are wrong, write us about it. Mr. Cushing will appreciate criticism.

We must again ask our correspondents to keep their articles down below the two-column limit. Long communications are crowded out, we have dozens of them on hand.

Correspondence

Runners vs. Engineers.

Editor The Locomotive Engineer:

This is the first time that I ever tried to be smart and take part in the discussion going on in your spicy little paper. I see a letter in August number entitled "Back Pressure and Full Throttle," referring to Grant's letter in May number. Now, Mr. Editor, Arnold says we are not engineers, but runners I will call myself a runner—not a twenty-year old one, not quite ten—and as I never intend to rattle my head about Pray's two volumes, or planimeters, I will never become an engineer.

Now I will tell you what I call an engineer. I may be mistaken, and if I am I hope some of the readers of your paper will correct me

In the first place, R R. Co.'s and Master Mechanics expect runners to understand the time card and rule book, that means to obey orders, which you must do if you wish to become a twenty-year old runner. They don't care a continental whether you are acquainted with Pray's second volume, and planimeters, or not (the M. M will look after those fellows); what they want is men to handle the locomotives on the trains economically, which you cannot do if you run them by Theory, and you have not got to have Pray's second volume, or Corliss valves all twisted up in your head to do it, and I will prove it

He says that he lent Pray's second volume to one of our engineers. The runner he lent it to is the man that runs the engine the 190 miles (on a freight train at that) over one of the worst roads in New England, at an average consumption of five tons of coal nightly. Now, Mr. Editor, don't you think this very good for a runner that would understand a Latin grammar just as well as Pray's second volume?

I have taken a train out of a terminal station two hours behind these Theory engineers, and find them on the up grades, making 12 or 14 miles per hour, and if their engine could speak United States it would say

"Darn-your-Theory!
Drop-me Down!"

I have helped these fellows up the grades, but not on Theory, when Theory gets his train over the last grade he gazes at his coal pile, and tells his fireman how light she is on coal; when he gets his train in the yard, puts his engine in the house, he makes out his time and finds that he has been 12½ hours making the trip, which means two hours extra time for each man employed on the train. This is no small item. The runner gets his engine in the house after pushing the steam expander on the up grades, he finds that he has been 10½ hours on the trip, which means no extra time, but a larger coal report, caused by pushing Theory up the grades.

A short time ago one of our men, who was always thinking about expansion and indicator cards, went out on his run. Thinking more about expansion than his running, he got over 37 miles of his trip all right, but after a stop pulled out with his mind away from his work; if it had been on his work he would have seen a switch set for a siding not far ahead of his smoke-stack The switcher was taking some cars out when he saw the steam expander coming towards him; the runner on the switcher stopped, and whistled, as a runner will in a case of this kind, the switcher went back where it started from with the cars, thinking the young steam expander would stop; he did stop—on the tender of the switcher—and then had the gall to ask the runner on the switcher what he was thinking about in not having a flag out—thought he was on the main track all the time; runner on the switcher called his attention to the track he was on, and to the rules in regard to passing through the yard.

How many twenty year old runners have we that learned the business and made a success of it by books? I don't mean to say that we cannot get some useful information in these books Twenty year old runners, when they start out on their runs, have their minds fixed on what they are about to do; they have not been up all night rattling their brains about indicators, planimeters or Pray's second volume, but they have learned, as I said before, to obey orders, take their trains over the road safely, and in case of a breakdown on the road to fix it in a very short time, and not block the road up when there is no need of it.

If the steam in the cylinders blows by the packing, they know which side it blows by on, they can tell you how air gets in and out of a brake cylinder, they can explain to you the different parts of the air brake, and tell you what they are for; if their engine does not run free and do the work it ought to, they can go to the M M. and tell him what the trouble is they know a little something about combustion (which is as important as steam expansion), they know enough to keep their cylinder cocks closed running in and out of stations, and by highway crossings, and several other little things the runner has learned, not by book knowledge or theory altogether, but by practical knowledge and common sense.

Mr Editor, who is it that runs the trains by the stations with the engine in the back gear, and, after the brakes are released, backs his train back to the station after standing the passengers all up in front of their seats (two minutes lost by this move), and out of twenty stops it will occur ten times? Who is it that runs their trains to the stations, and in making the stops finds that the brakes are not going to stop the train, and have to use the reverse levers to stop at the proper place? I think I hear you say it is not the "runner."

You may ask what is the reason of these kind of stops. There are a number of reasons. In the first place, Theory may be expanding steam too close to the station, and the old Westinghouse windmill does not get a show to do a good job; the reason for the second stop is that the Theory engineer has made so many applications of the air, that there is very little braking power left to stop the train. I have seen these kind of stops made with good working air pumps (this is what the runners call "steamboat stops").

They ought to learn something about the triple valve, which connects the brake pipe to the auxiliary reservoir and the latter to the brake cylinder. I don't mean to learn it all out of a book, and write it for some paper, and try to make us believe they have big heads; what I do mean is to go to repair shop, they will find one of these triple valves there, take it apart and tell us what they find. This is what I call practical knowledge, and you will not find it in Pray's second volume. the runner understands the air-brake, and when he wishes to stop at a station, he applies the brake at a proper distance from the station, with moderate force, the train is stopped gently and without inconvenience to the passengers, while, if they are thrown on with the utmost force possible, the train is jerked in a manner that is disagreeable.

Now about working steam expansively. Arnold says that if all locomotive engineers knew what it meant, we would have no trouble with it; I will agree with him there; they have got to learn it the same as the runners did. We have a number of twenty year old runners in this country who learned the machinist trade and then went firing a locomotive.

Arnold pays a compliment to the stationary and marine men at the expense of locomotive runners—says in that service knowledge counts, not years of service. I am inclined to think we all look through misfit spectacles at other trades than our own. I know a number of men in the stationary service that are discharged locomotive engineers, men who studied theory nights and worked at it running on the road so much, that they run by danger signals, and into other trains. Now they are in the stationary service, they are not "runners."

Marine service I know nothing about—only what I see on the road. These theory engineers will have an indicator card all snarled up in their heads, oceans of water in the smoke-stack, the front windows in the cab all plastered, and all they want is a compass to lay with the quadrant to let them know which way they are going; this is marine service on the R. R. The trouble with these kind of men is they try to be *too* smart, let them take for a study something that will help them to become "runners."

Let them find out what relation one part of the locomotive has to the other; get posted on the air-brake, so that they can tell what the several parts are for, and then, if they meet with an accident on the road, caused by the air-brake failing to work, they can give a description of the working of the brake. If they have to go to court in a case of this kind, they would have to tell the lawyers something, to let them know that they understood their business. They would have books and theory in the same room with them (not Pray's), and if they could say nothing they would say that the company was responsible for having a man handling something he knew nothing about. They would not ask you about Pray's second volume or to read indicator cards, as they have nothing to do with a locomotive runner. The twenty-year-old runner would answer all of these questions satisfactory, and there would be no theory mixed in it.

Arnold says we have too many of this class of runners in the country. I don't think we have. These are the men that help pay the dividends, these are the men that don't let the nuts all rattle off their engines and tenders before they tighten them up; they don't have to steal the car inspector's oil to make their oil report look smaller than the theory man's. There are a good many straws in a broom, and the runner is not any of the short ones; they are down where they are of some use.

Arnold says to Grant, "Fire away and I will help you out." I can't see where he has helped him out, so far. He tells us that he believed as Grant did; he tells us what he would do if he was M. M. (I never thought the M. M.s were so far behind the times). The next letter he writes I hope he will explain some of his theory, then I think he will be doing some good, and tell the runner how it happens that he is firing a 19 x 24 Baldwin Mogul (on a night run at that) over one of the worst roads in New England. You might say that he has not had enough of practical knowledge. How much does he want? He has been hearing her bark at the furnace door about six years, that's all.

Now, Mr. Editor, you say that this fireman's wholesale charge of ignorance of locomotive engineers, is no doubt based on what he sees around him; you should have said on what he had "seen" around him; he has not been on this "worst road in New England" but a short time. You also speak about his argument; I fail to see any; it is Grant's argument. What would you call these twenty-year-old men—engineers or runners? I would call them the same as the dictionary calls them, and as they have proved themselves to be, by long years of faithful service to the traveling public, as well as the company in whose employ they are—"locomotive engineers."

I say to Arnold, as he says to Grant, "Fire away, Arnold," and when your turn comes to be set up, if your head is not rattled or your eyesight is not impaired, so as you can stand the color test, the M. M. will give you a chance to show the twenty-year-old runners what you can do. Hope you will have the same luck that we are having to become twenty-year-old runners. H. T. R.

Hoosac Tunnel, Mass.

[We hope our correspondents will not become extremists, and each go too far in the direction of his hobby.

Every word that H. T. R. says of the requirements of the service is true, a man does not have to know anything about indicating to become an expert locomotive engineer.

The more an engineer knows of the details of his chosen profession the better for him; it may help him up in the scale in after years.

We look upon the indicator for locomotive service just as we do upon watches and clocks, only in a lesser degree.

The indicator card is the only way to thoroughly measure the work done in the cylinder of a steam engine, and adjust the mechanism to do the most effective work, it is not necessary that an engineer know how to make, adjust, or lay out the dial of a watch, but it is necessary that he know how to read the time denoted on the face.

It would be better if all engineers knew how, in a general way, to read indicator cards, and know by them what an engine was accomplishing or could accomplish—they can learn this easily and without even knowing what an indicator or a planimeter looks like.

The indicator is a measuring instrument, just the same as a two-foot rule is—a man might guess pretty close that a stick was three feet and one inch long, but he would never know for sure till he measured it.]

Detectives.

Editor The Locomotive Engineer:

Members of Uncle Sam's standing army are called soldiers, and they are regulated by hunger and the articles of war.

The members of the standing army of the railway corporations are called detectives, and are regulated principally by their own ideas, and the fears and follies of weak-kneed officials who employ them.

Once upon a time—fairy story style—there was a railroad, and that railroad had shops, and those shops were filled with men. They were not all wise men—machinists at $2.25 per day cannot be expected to be wise; wipers at 98 cents hadn't ought to be accused of knowing anything—and they were of devious and varied bloods; some there were from the land of Sweden, which is over against Denmark, and some of the tribe of Ham, from the village of Nianzin-on-the-Congo, and others were gathered from Italy, and Amsterdam, and Arkansas, and Vermont, and the rest of the odd corners of this universe, and one or two were from New Jersey. They were a motley crew, and they earned every cent they got.

But lo and behold, there appeared among them one day an apostle of a new creed, and he preached them a new faith, and he told those sore-eyed suckers from Missouri that they were a great people and the chosen of the Lord, and he gathered in their shining shekels, and took them into the fold and bade them eat of the bread of life—just as if they hadn't been living off bread and water long enough.

And when he had departed into the outer darkness, each and ev'ry one had swore upon a pasteboard altar that they were men and brothers, and would give their voice and their votes to men whose names should be revealed to them, and who would make laws requiring wages to be $6 per day and four hours a day's work.

And then they made mysterious signs to each other, and elected a grand desk pounder, a worshipful door slammer, and a grievance committee, and lo and behold, they were as one man(?)

Then they met upon the ninth hour of the seventh day and initiated other men into the mysteries, and called the roll and went through the order of business—and it transpired that upon each and every time when the order of business called for the "report of the grievance committee," there was no report forthcoming, and many there were who marveled thereat, and some murmured amongst themselves.

And it came to pass upon a certain day, there arose one man, who had sorrel-complected hair and a large mouth, and he denounced the grievance committee as lazy and inefficient, and disloyal, and no good, and asked that they be forthwith removed and sat upon, and another committee appointed in their stead. And when the faithful adjourned there was a new committee, and the sorrel-complected rooster was the head thereof, and the whole order was the tail.

And straightway the head man of the committee arrayed himself in purple and fine linen, and traveled up and down the land, and the foreman had to hire a new man to run the bolt cutter.

And when the faithful gathered themselves together again, the grievance committee had a report—and it was written upon a great scroll, in red ink, and it was to be continued in our next; but it started in something like this:

"Long-suffering and benighted brothers of the faithful few: Robbed of your rights, stripped of your manhood, with the heel of the oppressor upon your necks, look up! there is light, there is hope, there is plenty, if ye will but demand it. We must resist our oppressors, demand our rights, and assert our independence. If this order will follow the advice of this committee, in one week from to-day not one foreman who now lords it over you shall remain in the shops, not one man shall work there unless he belongs to the faithful. I shall carry the keys of the shop in my pocket, and each of you will come and go as gentlemen and brothers, and not, as menials and serfs, sneak up to the clerk and get your little brass checks—there will be no clerk, no checks. I have been forth upon the highways and the byways, and the men at all the other shops are clamorous for reform, they await your action, gentlemen. Will ye be men or serfs?" Etc., etc.

Then there arose a mighty cheer, and also a gray-haired old backslider in the rear seat, who asked that the report be received and that a committee be appointed to wait on the officers of the road, asking for an increase of pay. The head of the grievance committee denounced him as a traitor, and said the matter of pay was immaterial now, what was wanted was control of the shops and road—once make them feel our power and they will grant us anything. See?

And it came to pass that the next day an edict went forth that there would be a strike the following day, at 11 o'clock, for "good and sufficient reasons," and every man in all the shops of the road who belonged to the faithful struck, and many men who didn't want to be called scabs, they struck—but it was a tame strike.

The road service was not affected—it was a shop strike—but the officials of the road at once telegraphed to the Lieutenant-General of a Standing Army of Detectives, and forthwith the yards and shops were patrolled by an armed mob, under the guise of the law, with orders to carefully guard outgoing trains.

The company first thought of stopping trains, practically told the strikers they couldn't, and dared them to do it—then they wanted to.

I was pulling a row of cars out of a station 200 miles from the scene of the trouble among the shop men, and when I came down to go out the next morning, the strikers' committee interviewed me. They wanted me to refuse to go out, to strike without a grievance, get expelled from the brotherhood for sympathy for them, and lose a pretty good job, in a country where jobs were scarce and grub high. I kicked. I told them to keep their strike down to the men affected, and asked what grievance they had. Not one of them knew. One said, "We were ordered to strike from headquarters, and any man that don't strike is a scab. See?" I saw where his eye was, and hit at it—but it had been moved.

Then I went over to the engine and got ready to go out, when there came down half a dozen men with revolvers and shot-guns, and climbed on the cars and stood around the engine.

I knew several of them, they were bums about town, local toughs, men who never did an honest day's work in the town, and were the last men you would think would be selected as "protectors."

The strikers kept off the company's ground, but were within a few feet of us. When I started to pull out, two of the worst toughs got up in the gangway between the engine and tank. I stopped and asked the biggest one where he was going

"Got orders to protect this train," said he.

"Well, get back on the train and protect it," said I

"I've got orders to ride here, and I'm going to ride."

I commenced to get hot. "Not with me, you won't."

"Look-a-here, smarty," said the bluffer, "d'ye see that?" and he flopped the lapel of his coat over to show me a detective's badge.

I hereupon swore a mighty swear, declaring I didn't need protection from any low-down detective agency, or anybody else, and if I did need it, could protect myself. I wouldn't run the engine if it took a lot of armed bums to protect a man against a lot of apprentice boys, that were his personal acquaintances.

Then the superintendent came and ordered me to run that engine out of town, and that devilish quick, or he'd get someone that would. I told him to go plumb to Halifax and get somebody.

Then the master mechanic came and I explained the situation, and he went over and talked low to the superintendent.

I heard him say: "Now listen to reason; if you take him off that engine there won't be a wheel turning by night; you will have to take them all off. If you send out them deputy sheriffs on his train, you will have to send them out on all of 'em; now you let him alone."

Then they asked me what I wanted, and I told them I wanted to be left unprotected—never was a protectionist—and they hauled off their "detectives," and I went out "all by my lonesome"—and the strikers gave me three cheers, and didn't yell "scab."

That strike was dead in two days, half the men came back, the places of the others filled, but the detectives were everywhere "protecting the company's property" at $5 each per day.

And they stayed for more than three months. Every few nights there would be an explosion, or there would be an attempt to burn the shops. The lynx-eyed detectives were continually finding switches broken open and misplaced.

One night an officer of the road crossed the yard, and caught two of his "protectors" building a "scare" fire under the coal shute—and the next day they were gone.

I don't believe the strikers ever caused a cent's worth of damage, but the detectives busted up several cars and engines, and got pretty big pay for doing it.

Between the strike agitator and the strike annihilator—who both live off the strike—the poor striker is indeed like the grain of buckwheat—"crushed between the upper and the nether millstone."

Judas Iscariot was a detective, and the class that do the dirty work in strike times are very much like him—only worse. Judas, however, committed suicide—if I was a detective I should "go and do likewise." JOHN ALEXANDER.

Faster Time.

Editor The Locomotive Engineer:

In last month's issue you give a few figures in reference to the "Reading Flyer's" time to Atlantic City.

Engine 39, West Jersey Ry., Theodore Stratton engineer, George Bennett fireman, has been doing better than that all summer

Their run is to make 64 miles in 70 minutes with three dead stops; engine has cylinders 18 x 24.

The "Flyer" referred to makes no stops.

Engine 39 is one of the ordinary engines of the W. J., and on several occasions has had to beat this record, when being held on a block, or some similar delay. H. P. LIPPINCOTT.

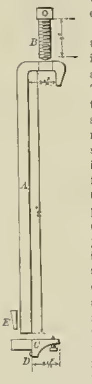
Bridgeton, N. J.

Another Good Spring and Equalizer Kink.

Editor The Locomotive Engineer:

If the patience of your readers will stand a description of one more of our spring "kinks," we will promise to give you a rest on the spring question in the future.

The arrangement referred to is used to pull down equalizers for the removal of, or placing in clips between equalizer and gib. It is used in place of the hook and bar arrangement mentioned in your May, 1889, issue, by Mr. A. T. Hooker, of Chattanooga, Tenn. The hook referred to requiring rather too much scientific (?) pulling on the bar by all the machinists, helpers and wipers in the house. Then, too, all first-class railroad companies now have Westinghouse driver brakes attached to their engines, and, where this is the case, the hook and bar cannot be used, owing to the space below engine frame being occupied by air cylinder. We used these hooks before air-brakes came into use.



The best tool we have been able to find for the purpose mentioned, is to take a piece of 1½" square steel and have it bent in form of **A**. This piece has a boss on top, through which passes a 1¼" x 5½ steel screw *B*; the foot *C* can be made of either steel or iron, a small, sharp-pointed set-screw passing through it, as shown. This foot has small projection on bottom, as shown at *D*, which holds pin used in adjusting to engines of different built frames. This jack is placed in position by placing the long steel piece perpendicularly beside air cylinder, close to engine frame, allowing the hook at top to drop over between equalizer and fire-box; this allows the tempered point of large screw to rest on top edge of equalizer. The foot is then slipped up an upright piece until point of small set-screw strikes bottom of lower rail of engine frame, and fastened in this position by driving home the wedge. As pressure is applied to point of large screw, the point of small set-screw is pressed into frame, which prevents it from slipping. The hook at top prevents the arrangement from slipping there, and the equalizer can easily be screwed down as far as desired.

This contrivance can be easily and quickly set, and is absolutely safe. We believe that safety and dispatch in doing the work should be considered while making tools, rather than original cost, for a good tool soon pays for itself.

We would like to talk with Bro. Hooker a little in regard to the jack for removing front driving springs, mentioned by him in your issue of March, 1889, for, if he adjusts this arrangement as stated by him, viz.: by removing pin at top and placing it in lower holes through side strips, we are afraid he had some trouble, owing to lack of space for top of inside strip between top of spring and boiler shell. L. C. HITCHCOCK

Minneapolis, Minn.

[No danger of anyone getting tired of new kinks to help them in their daily work. This paper wants to hear from every mechanic in the country who knows of an easier way or short cut in doing running repairs.]

Indications of the Indicator.

Editor The Locomotive Engineer:

Arnold, from Worcester, Mass., comes boldly to the front in August issue. I quote: "Not one engineer in 1,500 knows what the working of steam expansively implies," or "can read an indicator card." Well, why should they be able to do so? and do railroad officials expect it of them? I very respectfully, and with due reverence, call your attention to article in THE LOCOMOTIVE ENGINEER, in July issue. You will see a mention of two leading trunk lines, one double-track, the other a four-track road, that never, or, until recently, ever "indicated" an engine in their service. This recalls another article in regard to outside cups on steam chests on the M. C. R. R. That road cares very little about their firemen knowing too much of the indicator, or they would have moved these cups a boiler length nearer the stoker, and lessen the risk of losing one every bad, rainy and dark night. If this aspiring Arnold would write a letter of similar character to that of his "Pray"-ing one, and address it to the managers of all roads in the country, calling their attention to the fact that the indicator was seldom used, and he, an expert, was ready to instruct master mechanics, and lead them into the mysteries of the second volume of Pray, no doubt all the engineers would unite in Pray-er, and resolve that the country was saved from ruin, and dividends on watered stock would exceed two per cent. It is the phool American runner that is to blame for it, because he don't know enough to be called "*engineer*." Committees would no doubt be appointed, and petitions *Pray*ing that the reading of indicator cards be first in the general order of business at all their meetings.

How many engineers would ever be guaranteed in purchasing one now? for their watches are, in many cases, not non-magnetic The jeweler with the right kind of watches is always mentioned in the circular, announcing that their—the engineers' —watches are no better than "Waterburys."

The indicator and card may be entertained for a short time by the "super," who would soon ask "if it would get any more cars over the road." If it would not they have no use for it, let the indications be what they may. Brother engineers and firemen who get over 190 miles of road with 5 tons of coal (I know of many engines that require 10 tons every 90 miles), if you want to understand the indicator, follow these suggestions: Read Richmond's articles on the indicator in THE LOCOMOTIVE ENGINEER, get a copy of Le Van's Steam Engine and Indicator Practice, price 50 cents. Give Clinton B. Conger's idea a little attention (see page 6, August issue this paper). Hemenway's Steam Engine Economy and Indicator Practice is the best known work on the indicator. If the roads buy indicators and indicate engines, the pay for this expense must come out of something, pay-roll or freight receipts. Get all the knowledge in a general way you can, it may serve you in time to come. The indicator is not new, but it has come to stay. Why should you be expected by a fireman to know all about an indicator, when many new locomotives, fresh from the works, show no signs of ever having an indicator attached? If the man that makes an engine ignores it, should you be rebuked for following the example set by the builder. Will *Arnold* converse with the M. M. of his road, and find out how many times the Baldwin he fires has been indicated of late; also send THE LOCOMOTIVE ENGINEER cards of a 19 x 24 Mogul that hauls a full train 190 miles with 5 tons of coal? C. S. STRAW.

Watertown, Wis

Fred B Armstrong, of Camden, N. J., an old air-brake man, writes us his approval of the decision come to about the air-brake puzzle in last issue, and adds that, in running automatic with the old three-way cock, it is often an advantage to be able to have excess pressure to release; this can be had by temporarily closing the stop-cock between the reservoir and the three-way cock—where there is one.

The several correspondents who have inquired for the address of the makers of King's oil cup, shown in June number, will find them by addressing the Springfield Brass Co., Springfield, O

With the Schenectady, Baldwin's and the Pennsylvania people all working on the problem of compounds, we shall expect results that amount to something before another year.

LOCOMOTIVE ENGINEER
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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS

Notice to the Public.

Henry D. Cozens is duly authorized to receive and receipt for subscriptions to this paper, and carries written authority from the publishers to that effect.

The Pass System.

The agitation of Mr. John Livingston against the issuing of passes to anybody except Mr. John Livingston, and especially against the issuing of passes to railroad men attending conventions, shows more momentum than that usually given to the agitation of a known crank.

There is little doubt that the different railroad managers would gladly combine with any man or body of men who give reasonable promise of abating in a measure the pass nuisance, much less the abolition of it altogether.

The pass system has been abused, a case where the old proverb about riding a free horse to death has been literally carried out.

Everybody wants passes, those having the least reason for having passes want them the worst.

The Interstate Commerce Commission have attempted to restrict the issue of passes and confine their use to actual employes of the road; their efforts have been partially successful, and given the railroad officials an excuse for refusing passes to many persons otherwise hard to refuse.

But a remedy is never a cure, poultices on the outside of the pass cancer will never bring it to a head—it must be cut out, root, limb and branch, by the knife.

If every passenger carried over our roads paid fare, the companies could make money on their passenger business at one-half the present rate per mile.

It costs just as much to haul an alderman with a pass as a human being with a ticket.

The only way to stop the pass trouble is to do away with them for any purpose—not even using them for employes in the service of the company.

If the master mechanic finds it necessary to send an engineer and fireman over the road deadhead, let him give them an order for tickets, regular tickets be issued to them, and the mechanical department charged with them, at regular rates, on the books of the transportation department. It costs just as much to haul the engineer and fireman as it does any other two passengers.

If fares were down to one or two cents per mile, the brotherhoods could well afford to pay the fare of their delegates, then if any delegate wanted to take his wife he could pay her fare.

Most railroad employes dislike to pay fare—don't like to do it ourselves—but railroad men are more than half human, anyhow, and would soon get used to doing what other people do. There is no more reason why the family of a trainman should be carried free over the road than that the trainman should make a couple of trips without pay—what a kick there would be if some official asked that.

As long as one employe gets passes, all should; the general manager has no more excuse for using the pass privilege on his own road, or in asking it from other roads, than has any section laborer. If it is wrong for one it is wrong for the other.

About the only way to cut off the pass business is to make some such law against them as now stands against counterfeit money.

Railroad employes are not the worst pass fiends in the world. The press, the pulpit, the legislature, the bench, and all those institutions which influence the people, or are supported by the people, for the benefit of the people, are more or less influenced in favor of the roads by the use of passes, the abolition of the system would place all these where they belong—on a level with the people.

The pass system is wrong, and the ethics that it has taught is for abolishment, but a convenient evil is hard to give up.

Railroad men could but be benefited by a complete change in this direction, as it would reduce the fares they would have to pay, make the companies more prosperous, and the chances of higher pay better.

A Condition, Not a Theory.

From the general discussion going on everywhere, it is evident that most of the delegates to the engineers' convention will go thoroughly "instructed" on the subject—perhaps to the detriment of more important subjects—of the election of a grand chief.

This fight will be quite bitter, and, we regret to say, somewhat sectional. It will make little difference who is elected to office, if he is a good man, the opposition to Mr. Arthur do not seem to be united upon a candidate, so that his chances for re-election are reasonably sure—as election chances go.

We should be glad to see the order drop two-thirds of its secrecy, and commence open discussion of subjects tending to elevate the members in their calling.

We should be glad to see the qualifications for membership restricted, so that a man who was honest, temperate, industrious, and had shown by a year's work on the road that he was a capable engineer, could come in, and could not come in if he did not have these qualities.

We should be glad to see the order honest enough, generous enough, and just enough to declare that, if a man was true to the obligations of the order, it was none of the order's business what else he was true to.

We should be glad to see a regular order of business for subordinate lodges that called for the discussion of local changes in rules, time card and bulletin orders. This would insure more familiarity with changes, a universal understanding of rules and the settling of all points of dispute, thus reducing the chances of mistakes, the dangers to the men and to the public, and be to the welfare of the companies.

The brotherhood must be carefully and intelligently handled in the future, to keep itself in the position of the best labor organization of the country; conditions are changing, we must meet those conditions.

That the order has done good in times gone by, there is no question from any quarter. We trust the future will put the past in the shade.

Trucks on the Wrong End.

The belief is very common among American locomotive builders, designers and engineers, that it is almost absolutely necessary that trucks should be placed ahead of driving wheels to insure safety, and any runner on our roads would proceed carefully around curves when backing up.

On the London, Brighton & South Coast road, in England, they run a class of engines with four coupled wheels, 6 foot 6 inches in diameter, and a single truck with 4 foot 6 inch wheels; the drivers are arranged ahead, the front axle being just back of the smoke arch, and the truck under the fire-box. These engines were designed by Mr. W. Stroudley, the engineer of the line, and haul heavy and fast trains. The cylinders are $18\frac{1}{4}$x26, pressure 150, grate area, 21 square feet; total heating surface, 1,500 square feet. They haul 25 carriages, and run the 30 miles between Redhill and London in 40 minutes—20 miles of this being up a grade of 21 feet per mile—and the 51 mile run to Brighton is made on one run with 17 or 18 carriages in 62 minutes from start to stop.

We should not like to ride on a fast train over our rough and crooked roads pulled by one of these locomotives, but their success in England goes to prove that there are lots of things that won't do in one place will do in another.

Master Mechanics' Report.

Secretary Sinclair has sent out the Report of the Proceedings of the 22d Annual Convention of the American Railway Master Mechanics' Association, held at Niagara Falls, the 18th, 19th and 20th of June.

The work is uniform in size and style with the former issues of the report, contains over two hundred pages, together with a list of members and a complete index.

These reports, preserved from year to year, make a very valuable acquisition to any mechanic's library.

Secretary Sinclair is to be complimented on the neat and quick work he does with the reports.

"A Tale of Two Cities."

On the 16th of this month the 26th annual convention of the Brotherhood of Locomotive Engineers will convene at Denver, Col.

Denver, the "Queen City of the Plains," nestles at the foot of the great Rocky Mountain chain, whose massive brows are crowned with the eternal snows; before her stands the vast range, with its cool breezes, pure waters, living springs and hidden treasures of untold wealth—there is a future there. Behind her stretch hundreds of miles of arid plains, covered with stunted sage, wastes of sand and whitening bones, here and there is a little oasis, but the desolation predominates—that is the past, a history of the road.

It will be well if each delegate, on the night before the convention meets, will forget the squabble for office and the studies of rhetoric, and in his heart liken the great brotherhood to the City of Denver.

Put the arid plain of the past behind him, just as the pilgrims to Denver have put the plain behind them and the city, and look at the mountain of the future in the foreground.

It promises well; there are many chances for improvement and for wealth there, golden treasures as yet undiscovered—but there are pitfalls and precipices as well.

The city of Denver was built in a short time for a city so fine and so large—it is just the age of the brotherhood.

It was built because it was necessary for the best interests of the people of the territory about it—so was the brotherhood.

The pressing necessity of the times that called for hurried building and little examination of the materials used were the same in each case.

Denver is growing out of her "boom" time. She must now advance more slowly, build more solidly, and look to details more carefully—and so must the brotherhood.

Magnificent buildings have been reared in Denver upon the sand, they face unpaved, unsewered and unguttered streets—so stand many of the institutions of the order.

Denver is fair to look upon, especially from a height or a distance, her streets are wide, her buildings fine, her trees green and her parks pleasant and cool—not unlike the brotherhood.

But, while the city has her palaces, she is not without her hovels, she has a "Capitol Hill" upon one side, but "Poverty Flats" on the other, for the beautiful west side there is an offset in Wauzee street and the Chinese quarter—and still the city is like the brotherhood.

The representatives of the city of Denver are seeking to clean up the bad places, to run sewers through Poverty Flats; to heal the ulcers in Wauzee street; to pave the streets, and thus guard the health and happiness of all the members of the community—will the representatives of the order do the same?

Let us hope that they will forget the plain behind, and turn their faces toward the mountain of the future.

Let us hope that they will see their duty clear to remove every obstacle that hinders the advancement of any member of the order; let us hope for the repeal of every unjust law—not justice for the order alone, but justice for everybody.

The necessity for the rush to keep up to the railroad building in supplying men belonging to the order is past.

As Denver is obliged to clean up, go slower, and make some foundation improvements in order to hold her reputation as a city of the first order, so must the brotherhood be more particular about the selection of her material, build better foundations and provide for the drainage.

Every Man for His Trade.

Pedrick & Ayer, makers of railway repair shop tools, recently moved out of their old shop to a commodious building of their own, but the pressure of orders and the accumulation of work has made it necessary to reopen the old works as a repair shop. The firm have worked up a heavy trade in stationary repairs, piston and valve work, much of which is done at night, and the doing of which is in the way of and a detriment to the regular business of manufacturing. Now the older tools will be located in the repair shop, and the new work not affected in the least by repairs. A few years ago this firm started in to build special tools for repair shop work, the field was barren and seemed to most railroad men an unprofitable one, but one of the men was a thorough mechanic, and the other a thorough business man; they pooled their issues, but each attended to his end of the business, and let the other alone, if a man came in with drawings, or a model of a new machine, or suggested a change in an old one, Harry Ayer just opened the door and said, "Go right down in the shop and see Dan"; if, on the other hand, a purchasing agent came into the shop, and asked for 90 days' time, 60 % off or a chance to pay in store orders, Dan Pedrick just pointed to the stairs and said: "Go right up and see Harry." A mechanic usually has little business ability, and, as a mechanic, has little need of it; a business man may be a good one and not be able to bore a round hole with an auger, and don't need to.

It is the combination of abilities that makes a complete whole.

The engineers and firemen of Great Britain have a common brotherhood. Their *Journal*, published at Leeds, is an interesting one. Last month they issued a special number, containing a history of locomotive development. This work has been compiled by Mr. Clement E. Stretton, the society's consulting engineer, and is without doubt the most complete history of early English locomotives which has ever been placed before the public.

The price has been placed at only three pence, or six cents in U. S. coin—a cheap way of securing instructive reading.

ASKED & ANSWERED.

(40) T. E. H., Winslow, Ark. T., asks:

Where can I get the paint used on window signs to represent frosting? I want to ornament my side windows. *A.*—Mix stale beer and common epsom salts just thick enough so as not to "run" when used on a vertical surface; paint on with a brush. It can be removed by using hot water.

(41) Jno. S. Mills, Danville, Ill., asks:

Will you kindly send me, if possible, the questions asked by some good road, in examination on machinery—western road preferred. Also, questions on time card, if not too much trouble, and oblige. *A.*—The U. P. Ry. questions and answers, by Mr. Cushing, published on pages 10 and 11, are the best we know of.

(42) Woodstock, Westville, Wis., asks:

How many quadrants had the old Lawrence engines? Of course this means reverse levers as well. I saw a long time ago a Dubs engine at Winnipeg, Manitoba. She had a regular multiplication table on the quadrant. For what purpose? All these figures were intended for something. *A.*—All the Lawrence engines we have heard of had **V** hooks and independent cut-off, which required two quadrants and reverse levers. The multiplication table spoken of by our correspondent was no doubt one of the old style quadrants, that not only had the points of cut-off marked, but the points of release and compression as well.

(43) F. Hochbrunn, N. Y., writes:

I notice a good many straight shot stacks are two or three inches larger at the top than near the bottom. Can you tell me what advantage such stacks have over a perfectly straight stack? *A.*—Experiments go to show that the heated gases in the front end tend to reheat and expand the steam after it leaves the nozzle, and that in a large, straight stack, the escaping steam did not impinge against the stack until near the top. Where the exhaust does not fill the stack it acts as a loose piston, and does not make (in the language of the road) a strong pull upon the fire, and where it fills the stack for but a short distance its pull is jerky and uneven, and where it fills the stack it is more uniform and even. As the escaping steam is a piston constantly increasing in size, it was found best to make a taper stack for it to work in—where the proportions are right we believe they have produced a steadier blast on the fire and freer steaming engines.

(44) J. D. E., Denver, Col., writes:

All over the engine I fire is branded this puzzle, "8-30-C 397." What does it mean? *A.*—Baldwin's plan of shop numbers tell a great deal; the first figure tells the total number of wheels under the engine—yours is an 8-wheeled engine; the letters tell the number of wheels that are drivers. A for single pair of driving wheels, C for two pairs, D six, and E eight. The size of cylinder is indicated by the next figure; commencing at 12, the numbers run to 40, using *even* numbers only. These numbers denote the size of cylinder from 9 to 22, inclusive; thus, 30 means 16 inch cylinders. The last number gives the total number of that particular style built by the works. The fraction $\frac{1}{4}$ means a truck at each end of the locomotive, $\frac{1}{3}$ Forney style, so that, by the combination, you can tell the number of wheels in the truck as well. Thus, if there was $\frac{1}{3}$ after 30 in your number, it would show that there was a pony truck back of the fire-box; if it was 6-40$\frac{1}{3}$ C it would prove that the engine had no truck in front, for the 6 says six wheels all together; the C says four wheels coupled, and the $\frac{1}{3}$ a truck back of the box.

(45) I. T. U. D., Muckwonago, Wis., asks:

Does the crossed position of eccentric rods call for any change in position of *saddle* pin? If so, why not put up the blades or rods so that they will remain in a crossed position all the time? The continual changing of eccentric rods from an open to a *closed* and *crossed* position during each revolution of shaft must call for a remedy, to offset the consequent bad effect on valve. Is this probable bad effect on valve from alternate open and crossed position of the rods remedied through any peculiar design of the links or attachments to same? *A.*—Locomotives having rockers are not rigged with crossed rods; the rods are never crossed when the engine is on the forward center. The position of saddle pin is never moved from center line of link except on account of the angularity of the rod. If the eccentric blades were put up crossed, it would decrease the lead as the link was hooked up. Of course, the rods are crossed when engine is on back center, nothing is done to compensate for this, as it is an advantage. It would be impossible to put up the rods so that they would remain crossed while the engine was in motion.

Some Suggestions in Locomotive Design.

BY H. WESTON, RY. ENG'R.

While engines remain in present form they probably have reached the limit of speed at 70 or 80 miles an hour, the irregularity and imperfections of the roads putting severe restrictions on the planning or form of the locomotive. At present time, if, on account of improper roads, we cannot plan our engines for the attaining of very high continuous speeds, the alternative seems to be to increase capacity for heavy work, and the hauling of long trains. This may not directly serve the public to their liking as an increase in speed, and yet the running time of a train between points that include a number of intermediate stops may be considerably diminished if we have an engine heavy and capable of starting away from a station quickly, attaining its maximum speed after a few revolutions of the drivers, and not crawling out at a snail's pace, as the greater proportion of engines do, even when they are performing their best. This increased capacity for heavy work means a marked saving to the railways—indirectly to the public. If trains are heavier and longer, the number is reduced, thereby increasing the facilities of the road, promoting its efficiency, and prevents its being blocked by an excessive number of trains.

There is a chance for much improvement in the construction of an engine for heavy work. In the first place, boilers can be high and larger, thus giving an increase in power derived from them. Theory and practice prove that a high center of gravity in the boiler will make the engine steadier. The inequalities of the road or rails are transmitted through the wheels and springs to the frames, we may say, from the end of the short arm of the lever, the center of gravity of boiler is at the end of long arm, consequently the higher the center of gravity of boiler the more the force required to move it. Now, if boiler is so high that this force is not capable of swaying it, then irregularity transmitted to the wheels will be absorbed by the spring, and the engine will ride steadily.

In our engines, and especially in those for heavy work, the frames are a very important factor, and, in present practice, are far from what the service requires.

With a change in frames, longer journals might be available, thus giving a great improvement in cool running. Probably there are no engines, stationary or marine, where so heavy a strain (all elements considered) is put on so small a journal as in our ordinary locomotives.

When the long journal is possible, the width of shoes can be increased. All engineers realize the advantage of as long a life in these things as is possible to secure. The strains which are thrown between the jaws of the frames are tremendous.

When there is lost motion, every alternate stroke of engine tends to increase it and cause fast wearing.

In our engines for heavy service we should have at least six or eight driving wheels to utilize all the weight available, thus securing as much adhesion as possible, and avoid the crushing weight thrown on them when a smaller number are used, destructive to the wheels and rails. If railway officials realized the importance of a large coupled wheel base, there would be less destructive effect on rails. Such a proportion of weight as is common on the forward truck is a needless waste. Four-wheeled trucks should be retained as a guide, but sustain less weight.

A proper arrangement of securing cylinders to prevent any lateral motion or springing is important. Quite an amount of trouble has been caused in this way by cylinders throwing back and forth out of line.

The iron for a cylinder should be the best obtainable, and receive careful attention in casting. In quality it should be as hard as is consistent with a fine, even grain, free from air-holes, sand or grit.

The efficiency of a system of standards to work to is being fully realized, and should be carried out in quality and standards, from which can be secured the highest service.

The use of patent metallic rod packing gives such fine results that it seems strange it is not in use in every engine in the country. Piston rods on which I have put this packing, after having run a year continuously, have come into the shop, I might say, as perfect as when they were new Whereas, with the common packing a rod is badly grooved and worn within a few months, requiring constant attention and repacking, the metallic, on the other hand, requires no attention except to see that the nuts do not loosen, and to give the rod a slight oiling.

The running of a fine finishing feed over a rod, and then draw-filing by a machinist who knows his business, is the only proper way of securing the best results in working. The practice of filing a rod in the lathe is barbarous. If common packing is used, filing in the lathe does not make so much difference, as the packing soon grooves the rod; with metallic packing, draw-filing is important.

The use of the large, square bar, or two bars, for a guide, gives a more perfect form of crosshead, for the reason that the plan of cross-head can be such as to give a chance for easy and perfect adjustment, and the keeping of the piston rod working in proper line, which it rarely does when the common form or four-bar guide is used. They necessarily are so near together as to prevent the use of any but a solid head, and practically no chance for adjustment. Lost motion is destructive to the life of any machine, and also prevents it from giving the best satisfaction while running, and in a crosshead it causes much wear on piston rings, rod and rod packing, which becomes a serious matter in practice. Every one must admit that the use of a solid link is much preferable to one made of six pieces, provided it can be easily made. This can be done by forming a steel link to nearly the required size, and then, by the use of a special machine, grinding them and the blocks to their proper fit after they are hardened.

A slight modification, that will allow of large link pins, will be a great improvement over the present style.

The irregular exhausting of such a large proportion of locomotives shows plainly the want of a more efficient construction of valve connections.

The expense caused by the sucking of cinders through the exhaust is sufficient to make the best method of preventing the evil sought and used.

On some boilers built at the Trenton Locomotive Works many years ago, both flue sheets were curved out, for greater strength.

Northern Pacific Cinder Hopper.

On this page will be found drawings of the chute or gate used under the extension fronts of the N P. locomotives

Fig. 1 is a side view of the device—molasses gate

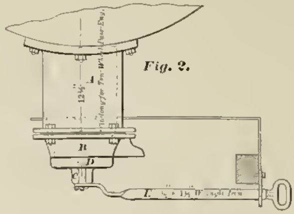

Fig. 2.

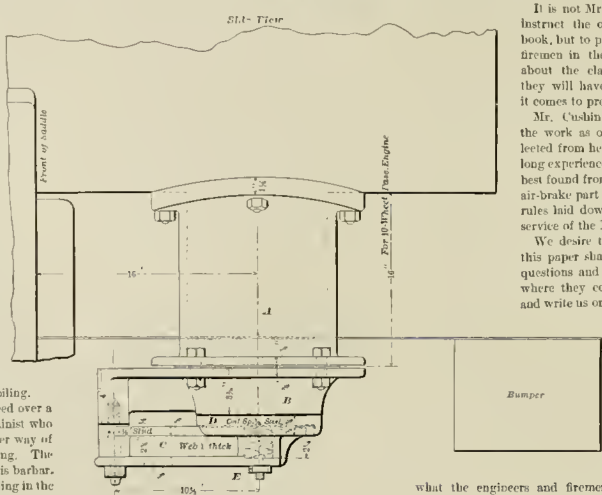

Fig. 1.

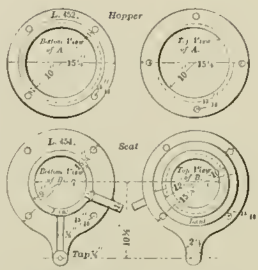

Fig. 3.

Northern Pacific Cinder Hopper.

the boys call it—showing the general arrangement. As will be seen, the valve is hinged to a bracket extending back from the lower ring of the hopper; to adjust this stud to make a fit between the hopper and the valve under all the changes of road service would be impossible, so the only office of the arm is to support the disk that closes the opening, this is a loose disk with a stem extending down into the arm and inside the coil spring shown, which keeps the disk face tight on the hopper face. Fig. 2 is a front view, and shows the operating handle, which can be located on either side; it also shows a projecting rib that keeps the disk in place when off the hopper, and prevents its cocking.

Fig. 3 shows the details of the device, sizes and all. It is much neater than the usual slide that has to be driven in and out with a coal-pick, is always tight, and easily operated.

Questions and Answers for the Examination of Engineers and Firemen.

Last month we mentioned the fact that Mr. Geo. W. Cushing, Sup't M P. of the Union Pacific, was about to issue a small book of questions and answers to the employes of the motive power department of his road.

It is not Mr. Cushing's idea to instruct the older men by this book, but to put young men and firemen in the way of finding about the class of knowledge they will have to possess when it comes to promotion.

Mr. Cushing does not claim the work as original, but as selected from here and there in his long experience, and adapting the best found from any source. The air-brake part was adapted from rules laid down in the mountain service of the N. P. road.

We desire that the readers of this paper shall look over these questions and answers, and see where they could be improved, and write us on the subject. Mr. Cushing is one of the kind of men who will be glad if the article calls out discussion, criticism and argument, and discussion and argument are, of all things, what the engineers and firemen of the country need to indulge in.

Mr Cushing says in his

PREFACE.

This book of questions is designed to aid in the line of examination for engineers who may be hired, or men promoted on the Union Pacific Railway.

The questions may be varied, as the answers will be, but the points referred to are a few of those important for each man in charge of a locomotive in service to know. Many experienced engineers are able to suggest other, and perhaps more suitable questions The writer wishes to meet the level of his friends, the firemen, who are to become engineers

G. W. Cushing,
Sup't Motive Power.

QUESTIONS AND ANSWERS.

First five questions refer to personal record.

Ques 6—What are the principal duties of an engineer before attaching his engine to train?

Ans.—To examine the engine carefully, to see that all set screws are in place, and rod keys secure; that the engine is equipped with all necessary signals, firing and hand tools; the necessary supply of water, fuel, sand and stores, also to take a look at the flues and crown sheet.

Ques. 7—What is important in carrying water in the boiler, as to height and regularity?

Ans. To carry water and steam in the top gauge cocks when working steam, and as uniformly as possible.

Ques 8—What is important in carrying water on grades, and approaching a summit?

Ans.—To carry the water sufficiently high to be sure that the front ends of tubes are not exposed, and in pitching over a summit to have sufficient water to cover and protect the crown sheet after finding its level from the front or low end of the boiler.

Ques. 9.—Should it be necessary, after pitching over a summit, to pump up a gauge or more of water, what should be the condition of the fire?

Ans.—The fire should be kept bright and burning freely

Ques 10.—Why is this important?

Ans—To prevent chilling the flues, causing them to leak

Ques. 11—Should you have ample water, after pitching over, what should be the condition of the fire?

Ans—It should be leveled and settled down, and covered over sufficiently to prevent unnecessary waste of steam or fuel.

Ques. 12.—Should the pump or injectors fail on the road, what would you do?

Ans.—First, smother down the fire, stop promptly, take off the hose, and raise tank valves to ascertain that they are connected, also see that the strainers are clear. If all is found clear, then try the injectors again; and if the engine has a pump, take it down and see that the valves are free, and would also run water through the feed pipes. When all is open and free, put them up and try them again.

Ques. 13.—Should the water in the boiler get too low to allow you time for the examination, what would you do?

Ans.—Draw the fire and send a messenger to the nearest telegraph office for assistance.

Ques. 14.—Should the water in the boiler become disturbed and foam, what would you do, and how would you ascertain whether it was foaming or being overpumped?

Ans.—As soon as the water is discovered discharging from the stack, would at once shut off and ascertain the height of the water solid. Should the water drop below the second or third gauge, would conclude there was foaming, and would again gently open the throttle. Should the water again rise and discharge from the stack, would put on both injectors, open the surface blow, when one is provided, and run carefully, allowing the bad water to be worked off through the surface blow, being very careful not to work the water in sufficient quantities through the cylinders as to endanger knocking out the heads, and would occasionally shut off to see that the water was not being thrown off faster than the pumps or injectors were supplying it. By this means the bad water would, in most cases, be worked out, and, with gentle usage, would again settle.

Ques. 15.—Should your engine break down on the road, what are your first duties?

Ans.—I would see that my engine and train were properly protected by sending flagmen in both directions, if on a single track, and if close to a siding, get on it as soon as possible, if it can be done without disconnecting engine.

Ques. 16.—Should the blow-off cock be blown out, or be broken off, or a hole be broken in the boiler in any way, what would you do?

Ans.—Draw the fire promptly, and send a messenger to the nearest telegraph office for assistance. Would then disconnect and get the engine ready to be towed in when assistance arrived.

Ques. 17.—What portion of the engine would you disconnect in such a case?

Ans.—Take off main rods and valve rods.

Ques. 18.—What do you consider the best practice in the use of steam on a locomotive?

Ans.—By using steam expansively to the fullest extent practicable considering the size of train and condition of road.

Ques. 19.—Is there any other gain by working engine with full throttle?

Ans.—We get practically a full boiler pressure in the cylinder.

Ques. 20.—What is important to observe in setting up or adjusting wedges?

Ans.—To have them so neatly adjusted that there will be no thump of the boxes, and, at the same time, not so tight as to cramp and not allow them full and free play on the pedestals.

Ques. 21.—How would you go about setting them up?

Ans.—Would place the engine at half stroke on the right side, block the left wheels, admit a little steam, and thump the boxes hard away from the wedges. Would then get under and put the wedges up solid with a short wrench, and make a side mark on the pedestals at top of wedge, then draw them down equally a scant one-eighth of an inch. Go over the left side in the same manner.

Ques. 22.—How would you keep up or adjust the side rods of a ten-wheel or a consolidation engine?

Ans.—Would place the engine on a level and straight track, and on a dead center, then slack off all keys on that line of rods, would then key the main connection first, leaving it sufficiently free on the pin to be moved laterally by hand, then adjust the front and back ends in the same manner; before starting to key up rods, would see that wedges were properly set up.

Ques. 23.—Why would you place the engine on exact dead center, and begin by keying the main connection first?

Ans.—In order to insure keying the rods of proper length to allow them to pass the dead or rigid points without strain.

Ques. 24.—Can the side rods be keyed too long or too short when not standing on dead center?

Ans.—They can.

Ques. 25.—If too long or too short, at what point of the stroke will the strain be?

Ans. While passing the dead or rigid points.

Ques. 26.—Should you slip the right back motion eccentric on the road, how would you reset it?

Ans.—Would place the engine on exact dead center on right side, place the reverse lever in full forward gear, and make a mark on the valve rod at the stuffing-box gland; then place the reverse lever in full back gear, and turn the slipped eccentric until the mark on valve rod came to its original position, being careful to see that the full, or throw of the eccentric was in position nearly opposite the forward eccentric, then secure it there.

Ques. 27.—In what way does the mark you made on the valve rod, while in forward gear, aid you in setting the slipped eccentric?

Ans.—The forward motion eccentric being in proper position, by placing the reverse lever in full forward gear the valve is brought into proper position on the ports, and the mark gives the position of the valve when the back motion eccentric is in its proper position, thus setting the slipped eccentric by the good one.

Ques. 28.—Should a valve yoke break, how would you test in order to determine which side was disabled?

Ans.—Would first place the engine at half stroke on the right side and admit a little steam to the cylinders, then move the reverse lever from back to forward motion, and if the steam could be shifted from the back to the forward cylinder cock, would conclude that the right yoke was good, and would test the left side in the same way.

Ques. 29.—Why would you place your engine at half stroke on the side you wished to test?

Ans.—In order to get the full movement of the valve over the ports on that side.

Ques. 30. After locating the broken yoke, how would you disconnect?

Ans.—Would take off the steam chest lid, place the valve over the ports, and block it there securely; replace the lid, take off the valve rod, take off the main rod, block the crossheads, and proceed with half train to next telegraph office, report and give judgment as to whether the engine would take entire train to its destination.

Ques. 31.—Should you blow or break out a cylinder head, how would you disconnect?

Ans.—First, take off the valve rod and close the ports with the valve, and secure it by cramping with the stuffing-box gland, take off the main rod and block the crossheads.

Ques. 32.—How would you proceed to block the crossheads securely?

Ans.—By placing crosshead at one end of stroke, and placing a block between end of crosshead and guide blocks to prevent it from moving, would secure the block to the guides with cord to prevent any danger of its falling out.

Ques. 33.—Suppose your engine had some patent metallic valve rod packing, and you had no gland to cramp the valve stem, what would you do?

Ans.—

Ques. 34.—Should the cylinder packing drop and blow badly on the road, how would you determine which side was down?

Ans.—In starting from a station, would notice the right crosshead, and if the blow occurred when it was leaving each extreme end of the stroke, would locate the blow in the right cylinder.

Ques. 35.—In case of the use of piston packing ring, which cannot be set out, blowing so badly that you could not haul the train, what would you do?

Ans.—First, take off or disconnect valve rod and close the ports with the valve, and secure it by cramping with the stuffing box gland, take off the main rod and block the crosshead, proceed with as many cars as I could haul.

Ques. 36.—Should you be running an engine which had but one pump, it being on the right side and connected to crosshead, and that side became disabled so that it would be necessary to disconnect it, the injector be too small or fail to supply the boiler, what would you do to avoid drawing the fire and being hauled home?

Ans.—Would disconnect the piston from the crosshead on the disabled side and take it out, put up the main rod and work the crosshead, which would give the use of the pump.

Ques. 37.—How should an injector be started?

Ans.—First, open overflow and feed cock, and see if water comes through the former freely, then open the steam valve gradually until water ceases to pass through overflow, but passes through check valve into boiler.

Ques. 38.—How should an injector be stopped?

Ans.—Close the steam valve gradually and shut the feed pipe cock.

Ques. 39.—How should an injector be converted into a heater?

Ans. Open the feed pipe cock, shut overflow and permit a little steam to enter the injector through starting valve.

Ques. 40.—In case of failure of injectors, what would you do?

Ans.—I should endeavor to ascertain the cause of the failure; if a broken joint, leak in pipe or obstructed strainer, I should examine all connections and parts in the injector.

Ques. 41.—Failing to get injectors to work, what would you do then?

Ans.—I should draw fire and protect boiler.

Ques. 42.—Should you break a top rocker arm, how would you disconnect?

Ans.—Take off the valve rod and broken arm, close the ports, and secure the valve with the stuffing-box gland and disconnect as in the case of a broken cylinder head.

Ques. 43.—Should the bottom rocker arm break, how would you disconnect?

Ans.—As a rule would not take off eccentric straps, but with an engine badly worn and loose in link hanger, so that the link could play about freely when running, would take off eccentric straps and disconnect as in case of broken cylinder head.

Ques. 44.—Should you break a link hanger, how would you disconnect?

Ans.—If but a short distance to run and no stopping or shifting to do, would run in without disconnecting, after cautioning the crew to keep the train under good control and stop promptly when signaled to do so. But if a long distance to run, would fit a block on top of link block, in proper position, and endeavor to make the run in this way; if it became too troublesome, would disconnect as in case of broken cylinder head.

Ques. 45.—In what way would you have lost control of your engine with broken link hanger, in case it was not practicable to run with link blocked up?

Ans.—Would only be able to reverse one side of engine.

Ques. 46.—Should you break an eccentric strap, how would you disconnect?

Ans.—Take off both eccentric straps on that side, and disconnect as in case of broken cylinder.

Ques. 47.—Should you break the back section of a side rod on a six-wheel connected engine, what would you do?

Ans.—Would take off both back sections, and run in with main and forward wheels connected, with about two thirds of the train.

Ques. 48.—Should you break a forward section, how would you disconnect?

Ans.—Would take off all side rods and run in without train.

Ques. 49.—Should you break a back or front section of a side rod on a consolidation engine, how would you disconnect?

Ans.—Would take off both back or front connections, as the case may be, and run in with two-thirds of train.

Ques. 50.—Should you break a middle connection on a consolidation engine, how would you disconnect?

Ans.—Would take off all side rods and run in without train.

Ques. 51.—Should you break a main crank-pin close up to the wheel, how would you disconnect?

Ans.—Would take off all side rods, and the main rod on disabled side, and run in without train.

Ques. 52.—Should you be running an engine which had a slide throttle valve, and it would strip or disconnect inside the boiler partly open, how would you manage?

Ans.—Would reduce the steam pressure within easy control, and state the trouble to the crew, and caution them to act promptly when called upon to do so. Would work the train, if freight, to the nearest siding, and back it off. If passenger, would keep the pressure within easy handling, and work the train to the nearest telegraph office, report and ask for orders.

Ques. 53.—Should one of the forward tires on a ten-wheel engine break, how would you manage?

Ans.—Would jack the wheel up the thickness of the tire, take out the oil cellar, and cut a block to fit the bottom of the box and journal sufficiently thick to hold the axle up in its place when resting on the pedestal brace; would then run in without disconnecting, provided the rod had not been bent or damaged by the broken tire. Would take in full train.

Ques. 54.—Should you break a main tire, how would you manage?

Ans.—Would first send messenger to nearest telegraph office and ask for assistance. Would then block up the axle and wheel the thickness of the tire, slack off the side rod keys, and run in carefully without train.

Ques. 55.—Should the back tire break, how would you manage?

Ans.—Would take off the back section of rods, block up the axle, run very carefully, especially around curves, to nearest telegraph office, report and ask for orders.

Ques. 56.—What causes steam chests to give out generally?

Ans.—Reversing engine suddenly without steam pressure in the chest will frequently cause them to burst.

Ques. 57.—Why does this result?

Ans.—The necessary cooling of the water and steam on metal surfaces being removed, a gas is formed by rapid friction, and possibly the explosion of this gas is the cause.

Ques. 58.—Should a steam chest burst or break, what would you do?

Ans.—If the steam chest leaked too badly to run the engine, would break the joint in steam pipe on disabled side by removing bolt, and insert a piece of sheet metal or board between the joints, and screw up the bolts again; take off valve rod and main rod, and block the crosshead.

Ques. 59.—Should you break a front driver spring or spring hanger, what would you do?

Ans.—Would take the spring out, run the back drivers upon wedges to take the weight off the forward drivers, and block between the top of driving-box and frame, then run the forward drivers upon wedges to take weight off the back drivers, pry up the end of equalizer and block it level.

Ques. 60.—If a back spring?

Ans.—Would proceed same as in case of front spring, but in reverse order; would not take spring out if there was no danger of its falling to pieces, as it would consume too much time.

Ques. 61.—What size wedges would you use to run your drivers upon, and how would you get them when needed?

Ans.—I would use wedges of oak about three feet long and four inches square, eight or ten inches of the top of wedge straight for wheel to rest on, and would see that I always had them on my engine ready for use.

Ques. 62.—In case of failure of water supply in tank under ordinary circumstances, what would you do?

Ans.—I should endeavor to reach a siding to leave my train and run to a water tank, except it was practicable to obtain a supply from some pond or stream near by.

Ques. 63.—If tank valves become disconnected from rods, what should be done?

Ans.—Would change the injector to a heater, obtain a good pressure in the feed pipe, then open the feed cock suddenly and blow the valve out.

Ques. 64.—Is there any risk of burning or bursting the hose in the operation?

Ans.—Yes; the starting valve and heater cock should be closed immediately after blowing out the valve.

Ques. 65.—In case of snow blockade and water low in tank, what would you do?

Ans.—If practicable, I should endeavor to shovel snow in tender, and in this way make water enough to keep engine alive.

Ques 66.—In case it was not practicable to do this, how would you proceed?

Ans.—I should keep the engine alive so long as the water lasted, and then should take down all water pipe connections that could possibly be damaged by frost, and blow boiler out clean, and be careful to leave no water standing in legs of boiler.

Ques 67.—What further would you do to protect your cylinder from damage by frosts?

Ans.—I should open cylinder cocks, slack off cylinder covers, and blow out or drain off what water was in cylinders

Ques 68.—In case you should burst a boiler tube on the trip, what should you do?

Ans.—I should endeavor to plug the flue with the means provided, and stop the leak

Ques 69.—In the case of use of water grate and the bursting of one of them, what would you do?

Ans.—If I was about to lose my water, should draw the fire to protect the boiler from damage

Ques. 70. In case of failure of spark arrester and the throwing of sparks to a dangerous extent, what would you do?

Ans.—I should report the difficulty to headquarters, and request to have train reduced to avoid using full power of engine, and in this manner reduce the danger of throwing sparks

Ques. 71.—In case of partial failure, ordinarily, of spark arrester or ash-pans, what is your duty?

Ans.—I should report to the nearest terminal point where such things could be repaired.

Ques 72.—What do you know about the draught arrangements in smoke-box of a locomotive?

Ans.—

Ques 73.—Why are exhaust pipes necessary in the smoke-box of engine?

Ans.—For a proper draught from the fire-box through the tubes.

(*Concluded next month.*)

IN THE ROUNDHOUSE AND REPAIR SHOP.

The Santa Fe has got their new Strong engine.

The N. P. road use sheet metal signal flags altogether.

The Masons have given up locomotive building entirely.

During the last fiscal year the Westinghouse Air brake Company have sold brake equipment to the amount of $3,300,000.

We would say to correspondent who inquired about size of drivers that the class K locomotives on the P. R. R. have wheels six foot and six inches in diameter.

Once more the newspapers announce that the Grant Locomotive Works will be removed from Paterson, N. J., to Minneapolis, Minn. They are building nothing at present.

Pedrick & Ayer, of Phila., are getting out the patterns for an extra heavy cylinder boring and facing machine, recently designed by P. Leeds, Supt. M. P. of the L. & N. Ry.

The Hinkley Locomotive Works are no more. All the machinery has been sold and removed from the shops, and the latter will be torn down to make room for an immense plant for the Electric Railway Co.

We have received large photos of two D., L. & W. locomotives, taken by Albert Bruen, an amateur of no mean ability. Among a large collection in our possession, they show the best work and are the clearest.

In times of peace prepare for war, is the proverb the railroads are now living up to, in making repairs to their snow plow and flanger equipment. The weather prophets promise a winter of harvests for snow-plow builders.

J. E. Lonergan, 211 Race street, Phila., manf'r of safety valves, oil cups, checks, etc., has moved his brass foundry to the fourth floor of his new building next door, and will lengthen the store room and office of his old place to occupy all the space formerly used as a foundry.

Mr Geo. Small has designed a new form of compound locomotive. The device will contain a new form of Strong boiler, having but one fire-box, in a large corrugated steel tube. Four cylinders will be employed, and steam got in and out of them by a modification of the present Strong valve gear.

The Pond Machine Tool Co. have recently furnished the N. Y. & New England with one of their heavy machines for turning steel-tired wheels with a tool cutting the full width of the tire at once; the machine weighs 23 tons. This road has also ordered one of their 79' driving wheel lathes with double quartering attachment.

A new car service valve has recently been put on the market by the Mason Regulator Co., of Boston, to fill a want expressed by several railroads and car-heating companies. It is to reduce the pressure separately for each car from the main service pipe, in which the pressure is reduced from the locomotive boiler to about 30 lbs. By its use a more uniform pressure can be obtained in each car throughout a long train. The cost will be very low.

Wm. Miller, locomotive superintendent Natal Government Railways, Durban, South Africa, writes Watson & Stillman, of New York city, that he has seen their advertisement of Vreeland's Transfer Jack in THE LOCOMOTIVE ENGINEER of February, 1889, and asks information and prices, with view to adopting on his road. He adds: "I may mention for your guidance that the gauge of our railway is 3 feet 6 inches, and the diameter of our largest engine wheels is 3 feet 2 inches."

The engineers, as an organization, have kept out of the proposed plan of federation of all railroad orders; but in many localities all the orders are signing articles of confederation for the system of road on the particular locality. The latest instance reported by the daily press is that of the employes of the Union Pacific system. The federated firemen, brakemen and switchmen have recently won some decided victories, and kept still about it—a grand improvement in itself. If federation properly governed it would be a good thing—the principle is all right.

The Rue Manf'g Co., of Phila., makers of the well-known Little Giant injectors, and the Rue boiler washing and testing apparatus, have recently moved their shop into the magnificent new factory building at 209 Race street, recently erected by J. E. Lonergan, the well-known oil cup manufacturer. The new shop has four times the floor space of the old, and some new tools will be sprinkled in among the old. Manager Colvin, while kicking in the orthodox way against the hard times, acknowledged that he was out of two sizes of injectors, and all hands making full time.

Angus Sinclair, Secretary of the American Railway Master Mechanics' Association, sailed for Europe on the morning of the 25th. His many friends—in and out of the association—tendered him a farewell banquet at Duke's Hotel, Hoboken, N. J., on the evening of the 24th. Angus Sinclair came to America from Scotland fifteen years ago, and sought employment as a locomotive fireman, a business he had followed in Europe. From the scoop he has worked himself up to the position of the foremost writer on American railway machinery. This he has done by the steady application of the "try, try again" rule, and both his record and position are ones he may well be proud of. He has sent out the following notice to members: "I expect to sail for Europe on September 25, to be absent seven weeks. I have to request members who have business to transact with this office to postpone it till I return, and if this cannot conveniently be done, to submit it to President Briggs, Memphis, Tennessee."

GEO. WESTINGHOUSE, JR., PRESIDENT. | T. W. WELSH, SUPT. | JOHN CALDWELL, TREASURER | W. W. CARD, SECRETARY | H. H. WESTINGHOUSE, GENERAL MANAGER

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The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped.

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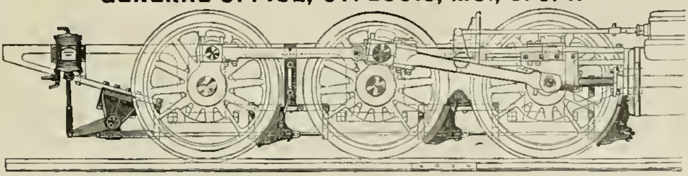

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Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers, furnished to operate with either STEAM or AIR.

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Far Better and Cheaper than Red Lead.

Makes a tighter joint than red lead, that can be opened with perfect ease many years after.

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Locomotive Grease Cup

Specially adapted for use on

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A POSITIVE FORCE FEED WITH PERFECT REGULATION.

Pressure on Grease can be instantly released by hand, without wrenches or screws.

Engineer can see at a glance whether Feed is on or off.

Tested on locomotive crank pins in hard daily service, with but one filling in one to four weeks.

Our "Lackawanna" Compound, specially recommended for these cups, is unaffected by heat or cold, having worked successfully at 30 below, and 95 above zero.

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IMPROVED UNIQUE AUTOMATIC SIGHT FEED LUBRICATOR.

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All our air brake cups are furnished *complete* and are ready to attach when received. There are no valves or pipe to be supplied by the user.

ALL WE ASK IS A TRIAL.

Send for illustrated pamphlet, fully describing above, before purchasing.

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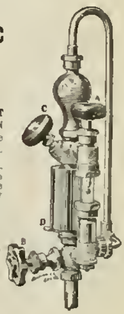

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Has just been issued by us, with descriptions of Air-brake Governors, Pressure Regulators, etc. Send for one to

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MANUFACTURERS OF SPECIAL
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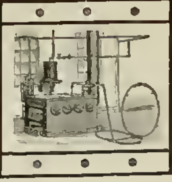
Apparatus for Heating, Setting and Removing Tires



A very complete arrangement for putting on new Tires, or taking off old ones, without removing wheels from under the engine. Will do all the work connected with tire heating, setting, removing, shimmering and replacing. With this apparatus and system of doing the work, less than one-tenth of the time is consumed, and the paint on the wheel centres is not injured.

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VREELAND'S
TRANSFER
JACK
Will Remove
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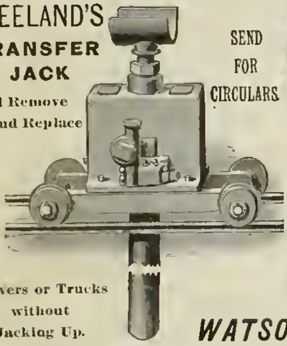

Drivers or Trucks
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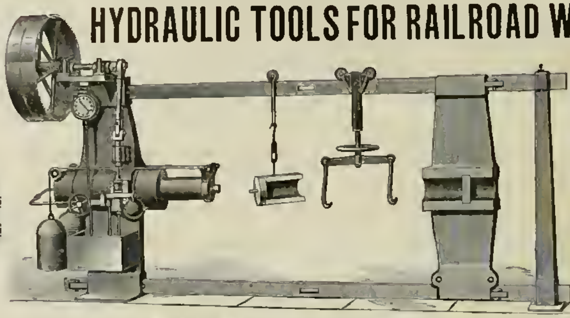

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With Rubber Core for Steam.
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CHESTER STEEL CASTINGS CO.,
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THE Vance Lightning Flue Cutter.

For removing Flues from Locomotive and Stationary Boilers One man can cut five hundred (one end) in a day. In use in the leading Railroad Shops of the country. Combination Cutter for removing 2", 2¼", 2½" and 3 inch Flues. $50. Sent on approval to Railroad Co.'s. Liberal Discounts to the Trade.

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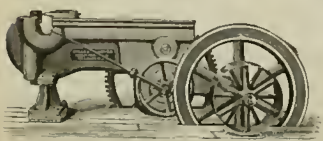
In connection with our line of Tools for above purpose, the Cut herewith shows our



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THE GLACE LOCOMOTIVE CHECK VALVE.

Three Separate, Distinct and Independent Valves in One Case, insuring Freedom from Sticking, and obviating difficulties experienced with old-style single valve.

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THE LOCOMOTIVE ENGINEER.

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THE SPECIAL INTERESTS OF
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LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO. XI. NEW YORK, NOVEMBER, 1889. 1.00 per Year or 10c. a copy.

The Drawing Lessons.

On another page will be found the first paper of what promises to be a most interesting series of articles on mechanical drawing and sketching, by Orville H. Reynolds, chief draftsman of the Northern Pacific Railway. Mr. Reynolds has "been through the mill," and knows all about the difficulties in the way of apprentices and mechanics, the want of time and the want of money.

He will therefore confine his articles to the use of the fewest number of instruments possible, tell you how to make most of them, but recommends their purchase, and proposes to use as examples of work just such work as will come up in the shop in every-day practice. He will write for you, using no algebra, no formulae, and when he calls a thing by a strange name will tell you what it is, and what it means, in a way that will be both interesting and instructive.

Get yourself a set of tools and follow these articles; it may result in your going higher, must result in good, and cannot possibly do harm.

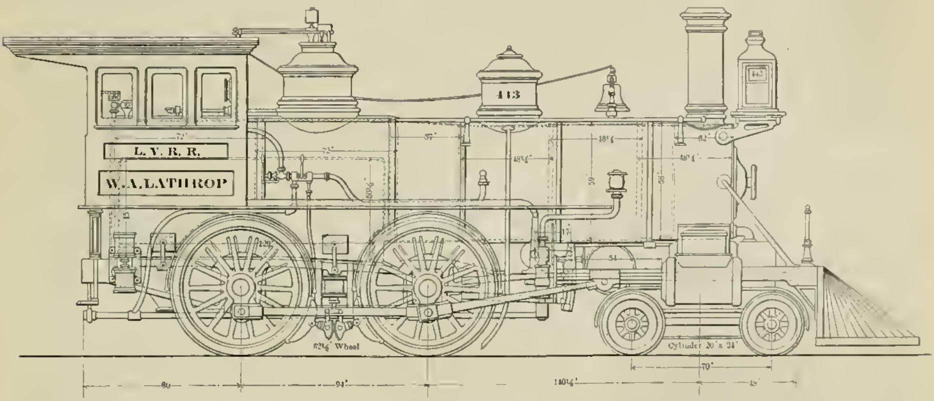
The Dark Ages.

We are in receipt of an instruction book, issued by the Union Pacific Railway, governing the instruction and examination of all employes interested as to the construction and use of the Westinghouse air-brake.

The day of shop and road mysteries has passed away; the day of ignorance, erroneous ideas, stupidity, looking wise and guessing at it, are happily on the wane.

Every effort is being put forth by the most enterprising railroads to educate their trainmen; little books are given free, where a disposition to discuss and use them is manifest. There will soon be forthcoming valve motion models, sections of brake valves, injectors and lubricators. The engineers, machinists and firemen of the future must know the *why* of these things; those who do not, will or cannot learn will have to quit railroading. How are you fixed? Are you posted? If not, why not?

On the C. Ry. of N. J. they are trying, with good success, a large exhaust nozzle with a cone in the center, the cone being supported on a threaded post that admits of its being raised and lowered. By this arrangement the exhaust is made to flare out and fill the stack, allowing the engines to steam with a larger opening than before the cone was tried.



A Lehigh Valley Locomotive.

The locomotive W. A. Lathrop, shown on this page, was built at the Delano (Pa.) shops in May, 1889, by John Campbell, M. M. Her sizes are marked on the drawing, and principal dimensions given in the following specifications:

Cylinders, 20"x24".

Steam ports, 16"x1¼".

Exhaust port, 16"x2½.

Valve travel, 5".

Links, steel with wrought-iron blocks, case-hardened. Radius, 72".

Driving wheels, cast centers with steel tires, 3½ thick, 5¼" wide; diameter, 62½".

Driving axles, steel, 8½" diameter, journals, 8 diameter, 8½" long.

Crank-pins, steel.

Main-pin bearings for parallel rod, 5"x3½ wide.

Main rod bearings, 4½"x4½ wide.

Parallel rod, back end bearings, 3¼"x3½.

Piston rods, steel, 3¼" diameter.

Guides, steel.

Crossheads, steel, with bronze metal gibs.

Journal bearings, all of bronze metal.

Engine truck axles, forged iron, 5½ diameter, journal bearings, 5 x8".

Truck wheels, 30" diameter, open pattern, steel tire, cast center.

Tender trucks, solid frames with M. C. B. standard axles, 30" diameter, open pattern, steel tire wheels.

Tank capacity, 3,000 gallons.

Engine wheel base, 22ft.x5¼.

Total wheel base, engine and tender, 47ft.x6¼".

Weight of engine with fire and water, 101,100 lbs.

Weight on driving wheels with fire and water, 73,100 lbs.

Weight of tender with fuel and water, 54,000 lbs.

Boiler, steel; shell sheets, ½" thick, fire-box sheets, ⅜ thick, diameter of smallest boiler ring, 58". All lap seams with inside lap pieces.

Length of fire-box, 129, width, 42½, height back, 45"; front, 50½".

Length of chamber, 5.

Length of boiler, 20 ft. 2". Supplied by two injectors and one pump.

The engine is equipped with the improved air-brake, also for steam heating.

Fuel, anthracite coal.

The left-hand injector can be started from the right side by a lever that connects to its lever. Special comforts are provided the engine men. Lehigh Valley engines are among the best finished machines running on the Atlantic seaboard.

We are indebted to Mr. Henry A. Richards, of Pullman, Ill., for spending a full half day showing us through the shops of that place.

Elementary Lessons on First Principles.

SECOND LESSON.

Let us just go a little out of our way to say that where the link motion is used on a locomotive without a rocker it is called a

DIRECT-MOTION ENGINE,

and the eccentric that is in gear, for instance the forward eccentric, when engine is running ahead, leads, or is ahead of the crank-pin, while the forward motion eccentric on an *indirect* engine, or one employing a rocker, follows the crank-pin, or is behind it, when engine is running ahead. Most locomotives running in America have rockers, and are therefore indirect motion engines.

Returning to the subject of the

SUSPENSION OF THE LINK,

you must remember that the angularity of the rod makes the piston travel unevenly, and that the angularity of the eccentric rods makes them move their ends of the link unevenly, and that these motions are tied together by the link, and the combined motion between the two points used to move the valves.

There are a great many other things to take into consideration in designing a link motion, any of which would distort the motion; but we will not go into these now, as the object is to explain *why* the link hanger stud is located behind the center of link, not to teach you *how* to lay it out

The ordinary link motion is not the best expansion gear, but it is the simplest and cheapest reversing gear known, and has almost superseded all other forms of motion for locomotive work

It is impractical to set the link motion to cut-off *exactly* square for all points of cut-off in both backward and forward gear, but it can be set to cut-off pretty nearly square where it is liable to be used the most; and, to enable it to do this, other points of cut-off are often left a little out.

We have seen that in practice the wheel moved in a steady and uniform motion, but that the piston moved further during one-half the stroke than during the other half, and consequently must move faster during one-half the revolution of the wheel than during the other half.

The eccentrics are set nearly quartering to the pin, so that when the pistons are moving the fastest, when sweeping through the center of the cylinders, the valves are moving the slowest; while, on the other hand, when the pistons are at the ends of their travel, and are therefore moving slowest, the eccentrics are at or near the quarters, and are moving the valves the fastest and the most, thus giving a quick opening at the beginning of the stroke. Now we have seen that the piston moves faster when on the forward half of the stroke, when the pin is nearest the cylinder, than on the back half, when the pin is away from the cylinder, and this difference in piston movement is made while the valve is doing the most work.

In designing valve motion, the position of the link is laid out as it would stand when cutting steam off at half stroke of the pistons, regardless of the position of the pins, as in Fig. 2, where the link numbered 1 shows the position when cutting off at half stroke for one end, and the link numbered 2, the position of same link when cutting off at half stroke for the return stroke of piston. The line *D E* is the center line of the engine, and the line *B C* the center line of the link motion.

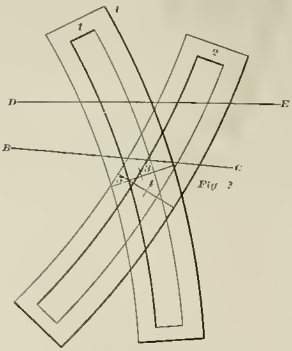
If the link hanger was fixed at *A*, and reached to the center of the link in either position, as at the points 3 or 4, the cut-off could not be even, as the hanger would not allow the link to move from 3 to 4

By selecting a mean point at 5, found at the intersection of the lines drawn across the center of the link, the motion is so modified in each case as to cut off steam at exactly half stroke, regardless of the angularity of the rod. If steam is cut off evenly at half stroke, it will be cut off very nearly even for other points. Links are sometimes suspended out of the center, for other reasons, which will be explained in lesson three.

It is the general rule in the old country to build locomotives without equalizers; each spring has its hangers fixed rigidly to the frame.

Special Breed of Cooking for Workingmen.

We are in receipt of a report from the consuls of the United States, concerning Cookery for Workingmen's Wives and Oatmeal Food, sent out by the Government at Washington. The pamphlet abounds in receipts for cooking various foods especially recommended for workingmen—foods



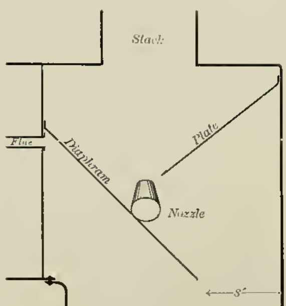
LESSONS ON FIRST PRINCIPLES.

that will presumably enable them to do more work than that on which they now subsist. This idea that there is anything different necessary for workingmen, either in food, clothes, school, church or state, is a bad idea to propagate. The workingmen want an opportunity to earn enough by their labors to buy such food for themselves and families as they like and need. Foreign receipts for cooking are rather cold comfort to the thousands of workingmen now out of employment in America. Some change must come, and that quickly, whereby every human being who desires to toil can find opportunities to do so, and at something like a fair remuneration for the service he gives.

The farther the "workingmen" are isolated and distinguished from the "upper crust," so much the worse for the crust in the final collapse.

An Early Extension Front.

We recently ran across the original drawings for an extension front end, designed in 1850 for one of the 8-foot wheel Camden & Amboy passenger engines, by Mr. Isaac Dripps, then Master Mechanic of the road, and for many years afterward Supt. of Machinery of the Penna. road.



The extension was principally down, and the diaphragms as shown are not far different from present practice The nozzle was high on account of the exhaust pipes entering the sides of arch well up —cylinders were on a line with them, but further back. This is, no doubt, the first.

The Travelling Engineer.

By J. E. PHELAN.

One essential point concerning the supposed duty of traveling engineers will bear considerable comment in relation to different kinds of engineers in service.

We all know that a certain percentage of men in charge of engines master the art thoroughly, so that instruction at any time is unnecessary. An idea imparted to such men to set thought at work is all-sufficient A mere suggestion is ample prompting to cover desirable points in practice.

This class and kind are born engineers, and practically traveling engineers themselves, insuring reliable service by their methods, and benefiting the general service by example shown in daily work.

Another kind of engineer is the one who knows enough to do work right, and care for engines properly; but having been born tired, need continual bracing up. They know when wedges are down; they know when rods need keying up, but from constitutional indisposition to work, they drive engines along in service until the machines resemble rattle-traps.

The mission of such men on earth—after gaining a place on pay-rolls as engineers—seems to be to keep the back shop and roundhouse filled with premature wrecks; keeping the mechanics busy; overcrowding the limit of the management's appropriation for repairs, and compelling good engineers to get excessive mileage out of engines kept in service by necessity, in order to keep up the general average in service.

While we are remarking on this particular point, we can truthfully say that we have known traveling engineers who considered such work fair; but we often find traveling engineers born tired—constitutionally—including both mental and physical forces.

With such men on engines, we claim it is the duty of the traveling engineer to take engine, engineer and firemen in charge, and devote time enough to subject in hand to remedy all accessible defects; and if necessary have particular attention paid to engine at terminal points for equipping with necessary requirements to insure performance of duty to maximum capacity. If the engineer's maximum capacity is of too contracted a standard to suit the requirements of the engine and service in hand, it becomes the duty of the master mechanic to apply a remedy.

But let us not forget the subject of teaching so far as within the duty limits of the traveling engineer.

On railroad systems where it is the rule to promote all engineers from ranks of firemen—and pay is regulated by several grades—more and greater chances, as a usual thing, are taken on class of men promoted, and the field for educating influence enlarged to a great extent. Under such circumstances the task of keeping the men up to the standard is increased, and the chances are that no amount of work will bring the average up to a decent respect for mechanical laws. Of course this portion of our remarks relate to territory where promotion as a rule is rapid, and mind and body denied that slow, deliberate fruition in experience which should be common.

We claim no traveling engineer's position is more desirable, or more to the point of insuring good reliable service, than where all engineers are held equally responsible in matter of keeping engines in proper condition to perform duty to a maximum capacity.

Under such conditions, where firemen are promoted, they should be of character to adopt deliberate methods, and by proper precaution, watchfulness, inquiry and study, be able to successfully manage engines without serious delays or expensive damage to machinery. We claim that every road has such men in employment, and we further claim that, where an intelligent traveling engineer can come in contact with such men, good results are sure to follow.

Where engineers are employed for road service, such employes should be fully up to the times in all matters pertaining to the proper management of locomotives.

There is a class of floating talent, perennially seeking employment as first-class engineers, who do more harm to the cause of good men and competent engineers getting positions than all other influences combined.

This class, as a rule, are graduates fully developed in all that is knowable about locomotives. Being employed on a railroad they start out to learn the road, and at first opportunity seek a soft seat or a bunk in the caboose, instead of remaining on the engine and learning important points about the service.

Should a traveling engineer be required to instruct such men? We simply opine, Not much!

When such men start out, unless the fireman happens to be kind hearted and experienced—experienced firemen usually lay off about such times—the engine managed (?) rests near the brow of every hill after nightfall. A coal famine shows up, and water gets scarce, and if the weather happens to be frosty it gets very interesting. Engineers of this class should be required to learn the road before taking charge of an engine. They should know how to handle air-brakes on freight trains, where such are used, and they should honestly aim to be in every particular what they profess to be—competent engineers.

When competent engineers, only, can get recommended for position, and be insured employment, the general standard of machinery and talent employed in care of same will average high, and the life of a traveling engineer become correspondingly happy

We must pay tribute to the *competent* engineers, who seek and gain employment, and by honest effort improve every opportunity in rendering good service.

The least that can be said is that experience, of the competent kind, is never better understood or more fully appreciated than by the reliable traveling engineer or the master mechanic; while the diligent mechanic in the roundhouse sings praises in his heart, as well as frequently with the mouth.

The traveling engineer who can silently, persistently and effectively sow seeds of understanding that may grow and bring forth fruitful results in insuring, or requiring, all engineers to locate defects about machinery or air-brake appliances, so that a machinist, after looking at the repair book, can go and place hand or tools on parts needing repairs, without having to guess for two hours to locate ten minutes' work—we say such results should warrant an everlasting and honorable reputation.

Simple Lessons in Drawing for the Shop.

By ORVILLE H. REYNOLDS.

FIRST PAPER

The apprentice of A. D. 1889 is in enjoyment of opportunities not dreamed of by his confreres of past generations.

What with well-lighted shops, latest improved machine tools, and an abundance of literature pertaining to his calling, there seems to be little to be desired, and those who thirst can drink their fill, thanks to such men as J. G. A. Meyer, Joshua Rose and others.

Preferment comes to him who is qualified for it, the dullard remains in the rut, and it would seem as though that grim fact ought to be a sufficient incentive to make the thinker burn the midnight oil, which he must do if his educational advantages are limited, or he expects to keep up with the procession.

There is no denying the fact that study after working hours becomes irksome, but when the reward for such exertion is considered, it should be a pleasure, and he who loses no opportunity to improve his mind will have no regrets

Anything which has the least bearing on the occupation should be read, and not only that, it should be studied until the subject is thoroughly understood

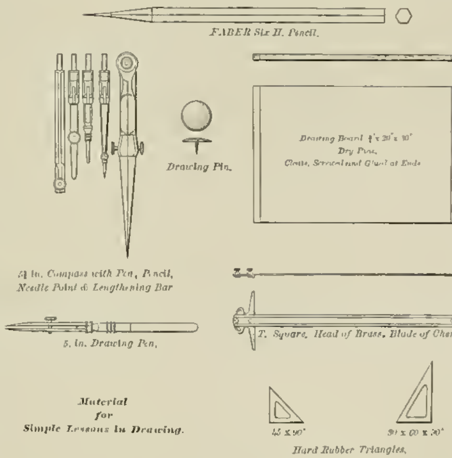
Waiting for six o'clock to come would have a different meaning to those who once found themselves interested in their books.

A fellow-feeling born of walking in their rocky road impels me to write these lines to a class of young workers of whom I had the honor to belong in the misty past, viz., the apprentices.

For him we purpose to give a few simple pointers in a homely way, so that, if he is so inclined, he can make himself understood in the universal language of a sketch, either free-hand or drawn to scale, and apply the lessons so given to the laying out of work with which he is familiar.

It will be necessary to have a few accessories to begin with; we will get them up as cheaply as possible consistent with good work First we require a drawing-board, 20"x30"x⅞" thick, preferably of well-seasoned pine; such a board can be made for $1.50 The only requirement being that the board shall be fairly true and smooth on top, and the edges square.

Next will be needed a **T** square, which, to serve the purpose, should also be made of thoroughly seasoned wood. Cherry is good, and holds its truth well Make the blade 1¾" wide with the two



SIMPLE LESSONS IN DRAWING FOR THE SHOP.

edges parallel, and true the whole length, which should be, in this case, 30". It should be $\frac{5}{16}$" thick, with a chamfer on each upper edge ½" wide, leaving the edges $\frac{1}{16}$" thick Sandpaper and shellac the blade on top, it will keep clean better

The square head can be made of sheet brass $\frac{1}{16}$" thick, having the front edge bent down at right angles to the body for contact with the drawing-board, and secured to the blade by two ¼" brass bolts with milled nuts, one of the bolts to pass through a circular slot in one side of head, making the blade adjustable to any angle within the limit of the slot, which is useful at times. I am aware this would not be called good practice in some quarters; but, as squares of this type are doing good service every day, it will be good enough for us. Such a tool can be made for $1.50, and, if properly built, will be a source of joy to the user.

The one thing necessary to make it a success is to be sure the fits of the thumb-screws are perfect as possible through the blade and head, any lost motion at those points will not cause a smile of gratification to flit over the artist's features.

If it cannot be easily made, then a plain, wooden one can be got up instead; make the head of cherry also, 2" wide and ½" thick. Secure to under side of blade by two nickel-headed screws Squares of this description can be bought of Keuffel & Esser, New York, for $1.20, or can be built by any good wood-worker.

Drawing-pins having German silver heads ⅜" diameter will be next wanted, only those with heads screwed to a shoulder. If there is a delusion and a snare in this beautiful world of ours, it is a drawing pin that insists on coming up through the head, to remind us that it is not, nor never was, a screwed head.

For triangles select two of hard rubber—one of these to be 45°x90°x5" long, the other to be 30°x60°x90°x5" long—the price of these will be 65 cents.

The most important thing of all to be considered now presents itself, *i. e.*, a choice of drawing instruments, which, while they will be cheap enough to come within the reach of all, will also be good enough to do anything like passably good work.

The instruments actually required to do work with are, One drawing pen, one 5½ compass with pen, pencil and needle point, and lengthening bar These are the bare necessaries, and can be obtained for $5 in New York.

These will fill all requirements to start with, but after getting interested in your work it will be discovered that a bow pen, bow pencil and bow dividers would be good to have; indeed, you cannot do without them if you care to do nice work. Their price is $4.45 for the set. The above are furnished with neat morocco case. It is much better to buy the instruments singly without the case, if it can be done, and purchase the case after the instruments are all procured. Remember, a cigar box is not a proper receptable for drawing instruments.

Instruments mentioned are of a cheap grade, as the price would indicate, but, while they are not "Alteneder's," they will do good work when properly handled. A few articles more, and the outfit will be complete. A triangular scale, divided to ⅛, ¼, ⅜, ½, ¾, 1, 1½, 3 and 4 inches to the foot, also one side to sixteenths, can be bought for $3 if metallic and nickel-plated. While these scales are convenient, they may also be regarded as a luxury A 12" steel scale, such as is used for shop work, can be used satisfactorily if it is necessary to dispense with the regulation draftsman's scale.

An ink slab with cover, 1¾"x4¼", will be something we will require when "inking in," which is going over the pencil lines with the drawing pens; the cost of such a slab is 50 cents. If desired, Higgins' prepared ink can be used instead of the cake, it comes in small bottles at 25 cents per bottle. The cake is best to use.

For drawing, a six H. Faber pencil is needed, and for sketching, a number 5 Faber pencil will be about correct.

For erasing construction lines, and cleaning the drawing after completion, it will be necessary to have a piece of soft rubber. Davidson's velvet rubber is the best. A piece ½"x2¼" is one commercial size, and convenient to handle.

A recapitulation will show what the cost of all the articles mentioned will be:

One drawing-board	$1.50
One **T** square	1.20
One doz. drawing-pins . . .	.60
Two hard rubber triangles .	.65
One set of drawing instruments..	5.00
One ink slab....	.50
One six H. pencil	.10
One No. 5 Faber pencil.... .	.10
One Davidson rubber....	.10
	$9.75

Which is certainly not an unreasonable price for the articles described. With such an outfit an effort can be made by him who is so inclined, that may lead in paths both pleasant and profitable.

The humble apprentice may, with the aid of these very humble instruments, become the chief stone of an important corner.

Copy of Circular Sent by the Westinghouse Air-Brake Co. to Locomotive Works.

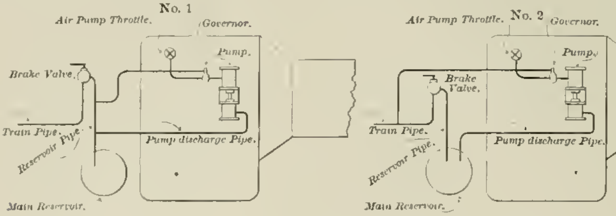
"We are occasionally in receipt of inquiries from railway officials as to causes of some supposed defect in devices employed in our brake system, which, upon investigation, is sometimes found to be due to improper methods of attaching the apparatus to an engine or car.

One of the most prolific sources of trouble arises from improperly arranged pipe connections on the locomotive, where the pump discharge pipe and the pipe leading to the engineer's brake valve are united, instead of which, independent pipes for each purpose connecting with the main reservoir should be used."

The sketches for which we are indebted to the *National Car and Locomotive Builder* will serve to make the reference clear.

"When the improper plan (No. 1) is used, quite an amount of moisture and filth from the pump is carried directly to the engineer's brake valve, and to the brake apparatus on the train vehicles, to such an extent as to sometimes impair their efficiency.

"When the proper method (No. 2) is used, the objectionable matter is deposited in the main reservoir, from which it may be drained at will, by unscrewing the plug, which should be placed in some convenient and readily accessible position. We have also *frequently found the pipe to the air-pump governors connected to the main reservoir.* This should *invariably* be connected to the train pipe, a union connection being provided at the engineer's brake valve which communicates with the train pipe. The sketches will also show proper and improper methods of connecting the air-pump governor, and should be considered illustrative only of the points we wish to convey. Proper union connections are provided at the brake valve for the gauge and governor.



WESTINGHOUSE AIR-BRAKE.

We trust you will co-operate with us in the desired reformation, if not already your custom, and take the necessary steps to inaugurate it at your works. Please acknowledge receipt."

The Union Pacific have just closed the contract for two Jull snow-plows. The Jull plow has a coned fan, with the point of cone supported near one rail, the cone hanging at an angle across the track. The Jull Manufacturing Company can well feel proud of Mr. Cushing's indorsement of their machine, if indorse it he does, after a thorough trial.

Break-Joint for Cylinder Packing Rings.

The break-joint blocks herewith shown are the invention of E. F. Peacock, roundhouse foreman of the P. R. R. at Philadelphia, and are in use on quite a number of locomotives on that road, five of them the famous class "K" 6½ foot wheel passenger locomotives. The block has been fitted to old pistons in badly worn cylinders, and done good service.

Mr. Peacock describes it as follows:

"Figs. 1 *A* and 2 *B* on the sketch show the blocks. Fig. 1 *C* is piston with rings and blocks in position. Fig. 2 *D* is section through piston-head in cylinder, showing position of block at bottom of piston, and showing a solid portion of the ring at the top of piston. The line in this that represents the cylinder bore also represents the outside line of ring, and the next solid line represents the inside line of ring. The dotted line is outside line of piston-head, and the inside solid line is bottom of ring groove. Fig. 3. "*E*" shows open space at *F*, where steam can blow through between the ends of ring, when no break-joint or dowel pins are used. The advantages that I claim in this break-joint are (1st) to obviate loss of steam, setting the rings out too tight, abrasion to cylinder, rings and piston-head. Also setting the rings out too suddenly, and breaking them. (2nd) to create a smooth enameled surface on the cylinder, rings and piston-head, easy reciprocating for piston, good results in train service, and a saving in fuel. (3rd) that the blocks can be used with narrow rings, which are preferred on account of less friction. The blocks can be used with a single ring as well as with two rings."

Snap rings set out by steam are the cheapest device known, but the sudden setting out at the ends, caused by the steam, and the compression, cause the cylinders to be cut at the ends, and when the ring becomes thin and old the sudden slapping of the rings against the cylinder breaks them.

Fig. 2."D"

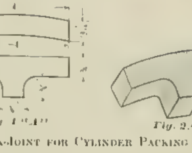


Fig. 1."C"

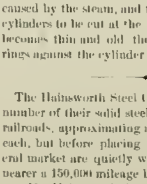


Fig. 1."A"

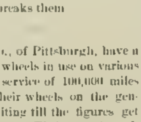


Fig. 2."B"

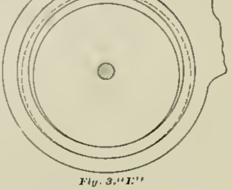


Fig. 3."E"

BREAK-JOINT FOR CYLINDER PACKING RINGS.

The Hainsworth Steel Co., of Pittsburgh, have a number of their solid steel wheels in use on various railroads, approximating a service of 100,000 miles each, but before placing their wheels on the general market are quietly waiting till the figures get nearer a 150,000 mileage basis. Their superintendent, Mr. Hainsworth, is widely known as a successful steel man.

About Correspondence.

We are in receipt of no less than eleven long communications on both sides of the subject touched upon by Grant, Arnold and H. T. R. While they are all good, and each make points, we will have to refrain from publishing any of them—it would be unfair to use one without the others. As a matter of fact, the most of them, on both sides, give too many opinions, leave out too many facts that could be stated, and wander from the real subject. In the first place, we let Arnold accuse the engineers of gross and universal ignorance, and then had to let H. T. R. reply. To carry the dispute further will not benefit anybody; we will gladly publish any reasons developed by experience, either for or against the practice of running with wide-open throttle, etc.; simple opinions prove nothing.

A Roundhouse Kink.

In the City of Brotherly Love the Pennsylvania Railroad Company own a roundhouse in which the locomotives head in. We noticed that in front of each stall there was a hole knocked in the brick work big enough to take in about half the pilots; some of these were arched up and left, others were simply holes just as they came from the punch. A little inquiry developed the information that they were made so as to let the big engines far enough in to close the doors behind the tanks; this done, the mills are backed up under the smoke-jack and cooled down. Why they did not think of swinging the doors out does not appear plain. In case of fire, every dead engine in the house would be in jail; if the doors opened out they could be saved by a switch rope and an engine. Curious conveniences that do not convene and many improvements that do not improve are concocted on railroads, even the great P. R. R.

Mr. H. D. Gordon, the able young master mechanic for some years in charge of the Philadelphia, Wilmington & Baltimore shops at Wilmington, Del., has been selected by the management of the P. R. R. to take charge of the new shops at Altoona, Pa., especially built for the erection of new locomotives. Mr. Gordon has received an enviable distinction in this selection, but the place he will easily fill in a quiet, business-like manner, wearing the same sized hat from first to last.

There are in use around the Pullman (Ill.) car shops over 400 little push cars.

Big Job of Moving Locomotives on Country Roads.

Those of our readers who think it an awful big job to get a locomotive on the track again, when once on the ground, or in the ditch, may be interested in a little account of the biggest job of moving locomotives on the ground that we have ever heard of. In 1862 Stonewall Jackson made a raid into West Virginia and Maryland to capture some railroad equipment; at Martinsburg he found thirty-eight locomotives on the Baltimore & Ohio road, and took possession of them. They could not be run either way on the road, as the Federal troops were in possession of important places each side of Martinsburg, but the army went prepared to take locomotives, they did not ask for rails, all they wanted was a sight of the mills.

This branch of the work was under the care of Mr. Thos. R. Sharp, who became, years afterward, trainmaster of the B. & O. The mechanical work was under the charge of John O'Brien, a young locomotive engineer scarcely twenty-one years of age, and who is now master mechanic of the Atlantic Coast Line, at Manchester, Va. Those engines must be secured and taken thirty-five or forty miles across the country to Strausburgh, on the Manassas Railroad, over the country roads of a hilly section; they must be got ready for their trip with the Yankee batteries shelling the robbers, and they had nothing to load them on except the comparatively light army wagons. Plenty of men, plenty of horses, and plenty of nerve was the principal equipment.

The engines were disconnected, and loose parts put into the tenders, the front trucks were taken out, ropes fastened to their frames, and four horses sent down the road at a gallop with each of them; the front drivers were taken out, hooks made to go over the axles, ropes attached, and a pair of horses to a pair of wheels saw them on the road. The front of boilers was raised up, an army baggage wagon backed under it, made fast, and away they went one at a time, the back pair of wheels trundling along on the ground.

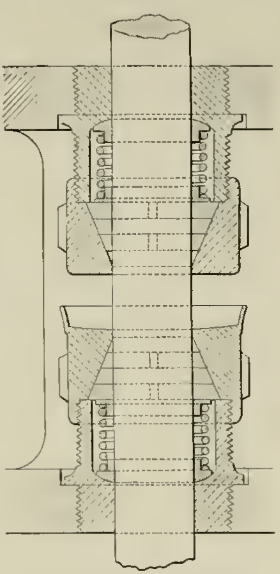
The first one went all right till it came to a down grade, then it got away, killed some horses, and turned on her side down a bank—this engine was placed on the road again and started in twenty-five minutes; this also taught the wreckers a lesson. The next one had a crude brake, across the frame, and fastened in the jaws, where the front axle ran, a huge timber was placed; enough men could get hold of this to help turn the engine, hold her, and prevent her turning over. In this way thirty-eight locomotives were taken nearly forty miles across the country. At one place in the road a turn about a steep bluff was so short it was deemed impossible to get the engines around, and even the commander was disposed to destroy them and go, but the mechanics in charge declared that, if given enough men and horses, they would take them *over* the bluff, and, although the sides were rough and very steep, they successfully got them over and to their destination, set them up, ran them South, and drafted them into the service of the Confederacy.

On another raid several locomotives were captured at Harper's Ferry and Leesburg, but they had only to run over the tracks South.

After the war the B. & O. made numerous efforts to secure the services of Mr. O'Brien in identifying their property, which was pretty thoroughly scattered over the South. Of course nothing but the necessity and excitement of war would induce men to undertake such stupendous jobs in handling locomotives. Mr. O'Brien tells us, however, that very little damage was done the engines, and all of them went to work at once.

Kellogg's Air-Pump Packing.

The metallic air-pump packing which is illustrated on this page consists of a conical nut, and three sectional rings with spring to keep them in place; it is understood that the peripheries of the packing rings are inclined to correspond with the conical opening, and the several packing rings decrease in size. When the several parts of the packing are in place the coil spring is compressed, and exerts an outward pressure against the packing rings; as the several packing rings are made in sections, and are pressed outward in the conical opening, the sections have a tendency to close toward each other, thus pressing firmly around the piston rod. A very secure metallic packing is thus formed around the piston rod, and all leakage is prevented, as the openings in the several packing rings break joints. The advantage of this packing is that it



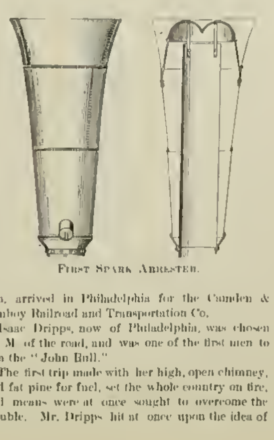
Kellogg's Air-Pump Packing.

can be taken out, and new put in without disconnecting any part of the pump. It will last longer, as it don't take as stiff a spring to keep it to the rod, as the rings are in section.

This packing has been in use on the N. P. R. R. almost a year, and is giving the best of satisfaction. One set, with proper care, will last three years at least. This packing was patented by F. G. Kellogg, a mechanic in the Brainerd shops of the N. P. Ry.

The First Spark Arrester.

In August, 1831, the old locomotive, "John Bull," now in the National Museum at Washing-



First Spark Arrester.

ton, arrived in Philadelphia for the Camden & Amboy Railroad and Transportation Co.

Isaac Dripps, now of Philadelphia, was chosen M. M. of the road, and was one of the first men to run the "John Bull."

The first trip made with her high, open chimney, and fat pine for fuel, set the whole country on fire, and means were at once sought to overcome the trouble. Mr. Dripps hit at once upon the idea of a deflecting cone and inside pipe to hold cinders, that from the very first became the standard spark arrester of the continent—a sound patent on the device would have been worth an immense fortune.

Some five or six years after the device was in use a stranger came along, copied the device, secured a patent upon it, and sued the Camden & Amboy for damages.

One of the company's important witnesses was old Jim Howell, the pattern maker, who originally made the patterns for base, cinder doors and cones. Jim was a good pattern maker, but had a habit of irrigating a little too copiously on all state occasions; so a guard was put on him to keep him level during the trial, but, as usual, he eluded them, and when he was called to the stand he was pretty drunk. The case, it seems, depended upon the prior use of a stack capable of catching cinders on the road, and discharging them when at end of run. Drawings of the device, as in Figs. 1 and 2 were upon the wall.

The lawyer against the company is cross-examining Jim:

Running his pencil down the drawing, he stops it at the cinder door at base of stack, which was marked *K* in the drawing

"Well, sir, what is this *K* here?"

Jim wabbled up to the edge of the box, looked at the drawing, and said

"Oh, h—l! There wan't no *K* there, it was a leetle cast-iron door to get cinders out!"

The very evidence the road wanted.

Correspondence.

The U. P. Examination Questions.

Editor The Locomotive Engineer:

In question 58 of Mr. Cushing's questions and answers for engineers and firemen, he says, "Should a steam chest burst or break, what would you do?" The answer he gives is this: "If the steam chest leaked too badly to run the engine, would break the joint in steam pipe on disabled side by removing bolt, and insert a piece of sheet metal or board between the joints, and screw up the bolts again; take off valve rod, and main rod, and block crosshead." Now, it looks to me, that it would be much better to take off chest casing, take out all studs in chest, take off valve, and lay a piece of sheet rubber or board over steam ports, take valve off from rod, and put back on and fasten there by putting in studs enough to hold it down with blocking between valve and chest cover. If chest cover is so badly broken that it will not hold valve down, take fish-plates or something of that kind. Then take down main rod, and block crosshead. To break steam joint, would make it necessary to go into front end, and to go into an extension front would be a hot job. With the short front a man could get at steam pipe much easier. Then answer to question 58 would be the best, but I can't see it in that light where the extension front is used. What are your ideas on the subject? Mr. Cushing does not answer question 33 in regard to holding valve stems where metallic packing is used, and you have no gland to cramp it with. I have seen valve stems with metallic packing fastened perfectly tight by taking off stuffing-box, and filling full of lamp wicking, and then screwing up tight.

Fireboy.

Fargo, N. D.

The Compound Locomotive on the B. & O.

Editor The Locomotive Engineer:

A departure from the regular American locomotive has just been completed for the B. & O. R. R. in engine No. 848, the departure being a compound or double expansion engine, having four cylinders, with one main rod for each pair of cylinders, one valve also doing the work for both high and low pressure cylinders.

It has the ordinary link motion without any rocker, giving a direct connection of link and valve—a saving of several joints, which is always an improvement. The high-pressure cylinder lies above the low, each having a piston rod that connects to one crosshead, which is made deep enough to admit of such connection, the front end of main rod being coupled to the crosshead in the usual manner, exactly between the two piston rods, which is so designed that the same amount of pressure will be applied to each piston while the engine is at work. The cylinders, high and low-pressure, are 12 and 20 inches respectively, and the amount of steam in the high pressure cylinder will do the same work as the exhaust does in the low-pressure one.

By this means the pressure is equalized on both top and bottom of the crosshead, avoiding any tendency to cramp in the guides, and unequal wear, the same as it would be if only one piston rod was connected to it in the center line of the main rod, with the same force applied to one piston, as here applied to both.

On each pair of cylinders is a plate as follows:

BALDWIN COMPOUND No. 1
Pat. June 25th, 1889, No. 406,011
Pat. June 25th, 1889, No. 406,012

Cylinders 12" and 20" all 24" stroke. Driving wheels 5' 6" with blank tires on front wheels to admit of rounding the sharp curves for which the B. & O. R. R. is noted.

Boiler is very large, 60" in diameter with the usual wagon top. Fire-box 9 feet long, and will burn soft coal.

The engine is fitted with a variable exhaust, thus placing the control of the blast in the hands of the engineer, which should prevent any trouble for want of steam, always having the 150 pounds carried.

As the cylinder plate reads it gives one to understand the building of this type of engines will be no small part of the work to be done by the largest locomotive works in the world.

The operation of this engine will be watched with much more interest than any previous change in design that has been made for many years past. As the question of to-day is, "How cheap can passengers and freight be carried, and what speed can be secured?" every manager and stockholder have the question brought very near their purses. I look at this as a step in the direction of economy. Engineers and master mechanics have been trying to improve the valve-gear of engines by many different schemes, which, while very ingenious have not as yet been able to replace the old link.

Now let them give the man a show who is trying to save something by using exhaust steam, which has been used to make engines burn more coal and throw a lion's share out of the stack or into the extension smoke-boxes. It certainly appears to those unskilled in the arts of locomotive practice, that any heat going out of the cylinders more than was required to burn the fire properly, is a dead loss, so it seems that compounding is a step in the direction of economy. We trust this will not be the only type of compound locomotive that will soon be tried in this country, and we await with interest the appearance of more in the field.

Germantown, Pa. O. H. RIDGWAY.

Don't Believe in the Gas Theory, nor in Going into Front Ends to Repair Broken Cylinders or Chests.

Editor The Locomotive Engineer:

I wish you would say how the answer to question No. 57 in Mr. G. W. Cushing's Union Pacific questions and answers strikes your every-day common sense. I do not think Mr. Cushing ever intended that any such explanation should get into print, as I know him to be a well-informed man.

When everybody knows the reason for a broken steam-chest or bursted dry pipe under such circumstances, why hunt around for a Keeley motor sort of an explanation?

Yet such men as H. T. R. learn that *this* is the kind of "theory" which is dangerous, and leads to "steamboat stops" on the other side of Jordan, after some of this same kind of "gas" has stowed the crown-sheet neatly in the ash-pan, and sent this kind of a "theory engineer" to talk with St. Peter about the "spheroidal state" in locomotive boilers.

Again, in the next question, No. 58. I think if I were a passenger on a delayed train, and went forward and found my man burrowing into his extension front to find that steam-pipe joint, I should class him at once with the young engineer Mr. Sinclair tells about, who was found in a snowbank shoveling snow down the smoke-stack to fill his boiler.

Why not tell the men to carry some sheet rubber with them, and block over steam ports in the chest, using steam chest lid to hold the blocks down—or a piece of plank if the lid were broken?

Detroit, Mich. E. H. MUMFORD.

A Kink for Water Stations.

Editor The Locomotive Engineer:

The sketch accompanying this article is intended to illustrate a condenser I have seen used in connection with a steam pump, with the double purpose of saving fuel and warming the water in the tub, so that service pipes for filling locomotive tenders will not freeze up. It is very effective, in some cases raising the temperature of the water to 70°, depending, of course, on the pressure of the steam, and the amount used.

This device is made by enclosing the suction-pipe, which we will suppose to be 4", with another pipe an inch larger. A tee with a 4" opening in one side, a 5" opening opposite, and a side opening large enough to receive the exhaust pipe, is used on one end, and a reducing coupling 4" and 5" openings at the other. The steam comes in to the tee, and passes along between the pipes where part of it is condensed, and into the stream of water at the opening *C* between the two parts of the suction *A* and *B* at the reducing coupling, where the rest of it will be condensed without any jar or rattling noise. This opening *C* should not be more than ⅜" wide, and should be made as much smaller than

that as will allow the steam and condensed water to enter the suction without any back pressure, by screwing the end *B* of the suction farther through the coupling. The end *D* has a thread on it, and after going through the tee is screwed into an elbow or coupling. This condenser can be made any length above 4', and if set perpendicularly should have the opening *C* at the bottom, to allow the water to drain out. On one railroad where a condensing device has been extensively used for four years, one of the pumps has a 3" exhaust coupled to the 3½" suction with an ordinary tee, and works smoothly and with less pounding than when exhausting into the open air. This pump lifts water 22' and forces 38 high, besides a horizontal distance of 150'. The exhaust pipe in this case enters the suction about 4' from the water in the river, so as to keep the pipes all warm; and I presume it works better when coupled as far as possible from the pump.

Do not understand that this condensing device will work well on all classes of pumps, for it will not. It seems to work best on pumps which have a crank and fly-wheel, and an ordinary *D* valve for admitting steam to the cylinder. Where a piston valve is used for shifting the steam valve, the condenser takes all the steam away from the exhaust, so there is no back-pressure to cushion the valve, and it will pound the end of the steam chest. Close the cylinder cocks tight as soon as possible after starting the pump, as the air will draw in and affect the working of the pump. There is not enough air in the *condensed* steam to make any difference.

The advantage of this style of condenser over a tee coupling in the suction is, that the space *C* can be made small enough so the water will not run up into the exhaust pipe at each stroke of the pump, and cause what is called "water ramming."

Lansing, Mich. C. B. CONGER.

Theory and Practice.

Editor The Locomotive Engineer:

No matter how much practical experience a locomotive engineer may have had, nor how old a runner he is, it is *never* going to do him a bit of harm to read or study some good work on mechanics, or the workings of a steam engine. You know the old maxim—"We are never too old to learn"—every word of it is true. Only some people make too broad a distinction between what we learn "practically" and what we find out by "theory." In order to become a first class man in whatever branch of life we may be in, it is absolutely necessary to gain *some* theoretical knowledge as well as practical experience.

Don't you suppose that a master mechanic would rather have you explain something in regard to your engine in a clear and concise manner, than in a slipshod and "know-nothing" sort of a way? If you want your draught pipe raised or lowered, don't you suppose he would rather have you tell him in a clear way just *why* you want it done, than to say, "Well, she don't steam very well, and I would like to *try* it higher or lower" (as the case may be)? Some may say, "What has theory got to do with that?"

I once had an engine just from the shop with a new style of stack on her, called a "boot-leg." She was a fine steamer when she went in, with her old "diamond" stack, but when she came out I could not do anything with her. She "stalled" three or four times in her run, and would not keep her thermometer more than ninety in the shade. My old engineer was an anti-book man, and on general principles wanted her nozzles made smaller—because she would not burn her fire (which was the whole trouble). Well, she had smaller ones put on her, and was twenty per cent. worse than before. Would not burn her fire at all. So be had still smaller nozzles put in her, and she seemed to be worse off—if that could have been possible. In fact, we were stalling everywhere. Other men tried her, with no better luck. One day a young runner got a hold of her, and said if they would put *larger* nozzles *than she had in the first place* on her, he thought she would be better. Every one laughed at him, but he stuck to his point and got them, and the next trip she was as hot as any could desire all over the division. I then asked him how he had found it out. He said that in reading some railroad work he had found that an engine would not burn the fire unless the exhaust steam *filled* the stack at every exhaust, and he said that in "priming" one day he had noticed that the water had shot out of the center of the stack without touching the sides at all—just as though there had been a 2-inch stream forced straight upwards out of the center. (I had noticed this at the time she "primed," but did not think much of it.) He had told the master mechanic all this at the time he wanted larger nozzles.

Now don't you suppose the M. M. was more pleased than if he had just said, "I want larger nozzles—because I want them"? I do; and if this same young runner had had that engine sooner, he would have found it out just the same, and saved the company lots of coal and expense.

Now I think that it is just those little (?) things that we get from books that are going to boost us in this great big world. Look at Mr. Angus Sinclair. He was once a locomotive fireman and engineer. Do you suppose that he never thought of anything else but to get his train over the road? I will bet that he had to study—and do lots of it—before he was promoted step by step to his present position. There is no use of getting Corliss valves and triple expansion compound condensation—or any other disease—mixed up in your head. I don't mean that these things *are* a "disease," but I say learn the locomotive—if you run one—as *thoroughly* as you can, and you will never have cause to regret it.

About the air-brake I will have to give in partly to H. T. R. You will have to go to the roundhouse and study one, if you want to understand it thoroughly. And yet there are lots of things about it that you cannot learn by watching its workings in the shop. For instance, the triple automatic valve that H. T. R. speaks of between the auxiliary reservoir to train pipe and brake cylinder. Can you see that work by taking it apart? No. You have *got* to learn its action from the descriptions furnished in books, and then it will pay you to go and watch one in operation. Not that you can *see* its operation, but you *can* see and understand the results of its workings. I have lots of respect for theory. There are many things that *cannot* be learned without the help of books; or, if you please, theory. Perhaps these non-theory fellows think that men who lay out valve motions do so with little sticks and strings. But do they? No. They lay it down on paper, and if the *theory* of the thing is correct they are not afraid of putting into *practical* operation, *trusting entirely to this* much abused "theory." This only goes to show the value of a correct theory, where it would not be possible to put a thing in practical operation at first without it. ROBT. B. READING.

New York City.

More Ways Than One—A Simple One.

Editor The Locomotive Engineer:

I notice question 33 in October number has no answer. Now we use metallic packing here in valve stem and piston stuffing-boxes, and the valve stem stuffing-boxes have an oil cup that screws into the gland. In case of a breakdown, cover ports, remove oil cup and insert a brass set-screw made to fit oil-cup hole, screw it down as tight as you wish, as the brass will not mark the stem and you have got your stem fast, you will find by trying that when set-screw is tight you cannot move the lever.

Green Bay, Wis. R. C. BELKNAP.

Rio Grande Air-Brake Car.

The Denver & Rio Grande road have an air-brake instruction car of their own, it is in charge of C. E. Leeman, one of the older engineers, and is taken from place to place, and all employes in train service are required to visit it and listen to the explanations until they understand it.

The car carries an upright boiler at one end, with air-pump attached, and has thirty brakes set up and in operation. These brakes are not all alike; some are the old style triple valve, some the new, quick-action, some are set to travel but a short distance, some full stroke, and the student is shown the cause, effect and remedy. One triple valve has a stem extending through its case and is attached to the stem of another triple valve that has a section of its case cut away, so that it can be seen just what is taking place under actual service.

Air-brake cars are good investments and more of them will be used next year than there were last.

Denver & Rio Grande—The Denver Shops.

(Editorial Correspondence.)

The Denver & Rio Grande Railroad is an interesting line of road for more reasons than one. It is a mountain road, its main line and branches crossing the continental divide of the Rocky Mountain chain no less than five times, it traverses many renowned canons and crosses and recrosses mountain streams until its bridge numbers reach into the four figures; it formerly had 1839.86 miles of track, but the Rio Grande Western—the Utah Line—secured a separate charter and became separated from the parent tree leaving but 1466.86 miles.

There are in use over 250 locomotives varying in size from 16,000 to 110,000 pounds and carrying cylinders from 7x12 to 20x24.

This road can be said to have been the first entirely successful narrow-gauge road; it has for years and is now carrying on its narrow gauge lines the same loads of freight on a 36-inch track as is carried on any of the standard-gauge roads of the country, their narrow gauge freight cars are of 40,000 pounds capacity and the writer has pulled cars of bullion over the road weighing 57,000 above the weight of the car. The road commenced in 1871 and laid a road along the base of the foot hills south 75 miles to Colorado Springs at the foot of Pike's Peak, this road was laid with iron, weighing 37 pounds to the yard, and the first engines were little Baldwin, narrow gauges of very small size. Frank Wilson, an engineer on the old Kansas Pacific, was hired to run the No. 1, and went "down east to Kansas" to bring his family to Denver. While he was there the No. 1 came and the management could not wait for Mr. Wilson and placed the engine in charge of Quimby Lamplaugh, an engineer on the Colorado Central; Lamplaugh was almost as big as the engine he ran. Both these men are still in the employ of the company, Mr. Lamplaugh as M. M. of the first division and Mr. Wilson as general road foreman of engines. The "baby road," as it was called, fared poorly for some years, built to Pueblo, 120 miles south of Denver, from there 40 miles west to Canon City at the Portal of the Grand Canon of the Arkansas and south 86 miles to the coal fields of El Mora and Walsen's, then the Santa Fe leased it for 99 years, but not handling the property to the satisfaction of the Rio Grande stockholders, the latter enlisted the men and took possession of the road in 1878 by force, which act was afterward sustained by the courts.

The discovery of silver at Leadville gave Colorado a boom, and the little road built in less than three years over 600 miles of mountain road, with scarcely a mile of straight track and with grades varying from 75 to 217 feet per mile.

On all grades less than 200 feet per mile the men run 105 miles for a day on passenger—unless the division is less than 105 miles long, in that case they get a day for the division—and 85 on freight, engineers receive $4.00 per day and firemen $2.40, firemen on broad-gauge "hogs," 20x24, receive $2.65. On grades of over 200 feet per mile 44 miles is a day's work, for all delays of over one hour the engineer receives 40 cents per hour, the fireman 24 and 26 5 cents.

Just now the men are running very hard and all making $200 per month and over.

In 1880 a third rail was laid from Denver to Pueblo to accommodate the Sante Fe trains and several broad-gauge locomotives were bought; now there are in service about 50 broad-gauge locomotives and the third rail has been laid on about 300 miles of track and in the case of the El Mora branch the narrow-gauge rail taken up, the broad-gauge road is being extended rapidly and there is little doubt that the entire main line will be standard gauge in two years. This is not done because the narrow gauge was not a success, but because of the delays incident to transfers that cut into the through California business, that has grown wonderfully.

The main shops are located at Denver, with smaller ones at Pueblo, Salida and Alamosa, of which I will write at another time.

The car shops at Denver are large enough to keep up the entire service of 7,000 freight and 218 passenger cars, but the recent purchase of large numbers of new broad-gauge cars, and the evident intention to let the narrow-gauge freight cars wear out, make these shops comparatively dull.

The main shop is a fine brick structure of modern design, having a large number of modern machine tools located in one end and the pits, seven in number, in the other; the boiler shop and blacksmith shop are the same length as the main shop, but not so wide, and are separated from it only by the width of a transfer table capable of handling the largest locomotive.

On the opposite side of the main shop from the transfer table there are three wings, the center one containing the engine and boilers, one the copper shop and the third the tool room, separated from these wings by a supply track is the storehouses, and behind this, and next the main tracks, the offices.

There are two roundhouses, only one being used for engines in service, the other being too small, and as the one used has but 12 stalls and the Rock Island use the same house, more than half the engines stand out. The roundhouse is in the charge of Charles Sisler, and the generally good condition of the engines attests his ability on running repairs.

The back shop is under the supervision of General Foreman John Bryman, the blacksmith shop under W. W. McLellan and the boiler shop under John Mitchell.

The engine room has a large plain slide valve engine and an octagon frame, on each side of which is located a long stroke air-pump, these pumps engineer Ed. Kenna calls his "organ"; they supply air to the system of pipes and drums that cover the entire plant. In the coach shop and car repair yards, long hose connections are located at convenient points and connected to an underground system of pipes to test brakes on cars without the use of a locomotive. An air-pipe comes down between every stall in the roundhouse and a hose connected to a T in the blower pipe is used to hurry fires and prevent smoke when firing up cold engines. In the back shop and the boiler shop small slide valve engines on trucks are run by air to drive boring bars, drills, valve seat planers, etc. Most of the machine tools are of recent build and good quality. The shops are light, well ventilated and well heated.

The narrow-gauge passenger locomotives are mostly ten wheelers, 14x22 with a 47" wheel. All the narrow-gauge freight locomotives are consolidations; the smaller size, mostly used on branches, are 15x18, 36" wheel, and boiler 48" diameter; the second size are 15x20, 36" wheel and 50" boilers, and the larger class, 17x20, 36" wheel, and boilers 52" diameter—a pretty big boiler for a 36" track. The work that these engines do is remarkable, their average train on a grade of 217 feet per mile being 5 loaded cars. One of these little monsters does a regular business on the Calumet branch, eight miles long, with an average grade of 303 feet per mile and several places where it reaches 409 feet per mile.

The passenger locomotives have straight stacks and extension fronts, the freights short fronts and diamond stacks—all the broad gauge equipment have extensions.

The native coal used on the road is of an extraordinary good quality.

Everything on the line has undergone the enlarging process just as the locomotives have, the original 37 pound iron rails grew to 40, 46, 52, 60 and finally to 72 pounds of steel per yard. On a road moving its freight with such small wheels and on such grades the repairs are a matter of great importance, but Mr. Sample, the Supt. of M. P., has kept himself out of lots of trouble and the road out of lots of expense by adhering strictly to one make of locomotives; all the locomotives are Baldwin build excepting 28 Grants, that, since they have been rebuilt, are practically Baldwins.

The older consolidations used have a very short main rod and the wear of crossheads and guides is considerable, while trouble has been experienced with pistons breaking at the crosshead, the new consolidations have the main driver next the back pair instead of next the front, and they give much better service. A curious experiment is being tried on engine 202—a narrow-guage consolidation; the pair of drives next the back pair are close up under the front of the long fire-box, prohibiting the use of eccentrics there, but on this engine they have put the main pins on this pair of wheels and lengthened out the main rod, leaving the eccentrics where they were on the axle ahead, the engine has been running some months now, is square, doing well, and requiring less work on her guides, it is no doubt an improvement.

All the new broad gauge locomotives have the Sample boiler, wagon-top with radial stays, dome on wagon-top ahead of fire box, the passenger engines are 18x24 10-wheelers, the freights consolidation 20x24, weight 115,000 pounds, every locomotive and car owned by this company is equipped with air-brakes.

Many of the older locomotives have had their cylinders bushed when bored out too large, a cast bush is turned and bored and forced into the cylinders; no trouble has ever been experienced from these bushings, many of which have been used for five years.

"They ain't got much the best of us old timers arter all," remarked an old gentleman in a crowd of Jersey Central commuters the other day as they walked from the train in Jersey City to the ferry-boat. "Not so awful much; now look a there!" and he held the end of his umbrella against the Baldwin plate on the side of the smoke arch. "Eighteen-forty-three, sir! 1843, and how much better are they maken 'em now—a little bigger, that's all!" The innocent old gentleman was pointing to the "shop" number on an 8-wheeler about 15 or 16 years old.

Patrick Keys, Green Bay, Wis., writes to the L. E. thusly:—"I get more for my dollar from you than from any other publication I know of. *I only wish your paper was a $4.00 weekly* instead of a monthly."

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An Awful Lesson.

Since the last issue of this paper there has been another railroad disaster of a particularly sad nature. A suburban train on the Rock Island road was run into by a freight engine, killing seven persons. The freight engine was run by a son of General Master Mechanic Twombly, who, it is alleged, was drunk, and running ahead of time in a reckless manner. Twombly and his fireman are both held for manslaughter, and M. M. Twombly was also arrested as an accessory before the act.

That the engineer was drunk on duty there seems little doubt, and final punishment seems just—no excuse a man can make justifies him in going out upon a locomotive drunk.

That the fireman is to be held responsible in the premises seems strange. The fireman has no authority in the movement of a locomotive, any more than a cabin boy has in the movement of a ship; he is there to obey the engineer, and if he undertook to run things, ever so little, he would soon find himself at outs with the engineer, and out of a job The companies employ and put on locomotives as firemen men from every walk in life, without regard to any qualification whatever, and that they should be entirely under the control of the engineer is right under the circumstances. This boy had no choice—he was like a common soldier—there to obey. He should be held blameless

No doubt Mr. Twombly has in his thirty years as master mechanic forgiven many another man for drunkenness, and given him another trial; but this case, the culprit being his own son, makes the case a sad one for him; but his prosecution for crime in this particular case, while it might tend to increase the vigilance of railroad officials in the punishment of drunkenness, would seem like persecution.

If the freight train had been provided with air-brakes the accident would never have occurred; it is claimed if the engine even had a steam-driver brake it would have been stopped. If the line had been provided with block signals—and the accident occurred right in the city of Chicago—the train would have been stopped or derailed. For this lack of proper modern appliances the Rock Island road is to blame.

We do not believe that any man or company of men, railroad or railroad official, has got the right to say to any man, "You shall not drink" But the railroad officials have got the right to say that any man who drinks intoxicating liquors, on or off duty, shall not run a locomotive under them; and this is just what they need to be saying and doing.

The brotherhoods ought to be singling out those who are known to drink, and drop them, instead of making a kick to have men reinstated who have been removed for drinking.

Too many men are daily risking their lives against such men as they know are not safe, and liable to cause a disaster at any time It is time that, in cases of this kind, where it is clearly proven that modern safety appliances are not employed, the railroad companies should be held responsible. That competent employes get along every day without them is no excuse—a competent crew might bring a ship into port many times with a cob driven into a knot-hole; but the cob would be liable to rot out at any time

It is also time that all competent employes arrayed themselves against strong drink, the lives of all quiver in the balance of every engineer's judgment—don't let any man run against you, and see that you run against no man, where there is the slightest fear that whisky may throw the scales out of balance

Butchery for the Want of Modern Appliances.

Last month a terrible rear collision on the N Y Central at Palatine Bridge caused the death of five or six people, and crippled many others. The special car of President Ledyard, of one of the Michigan roads, was on the rear of the first section of the St. Louis express, and at the place mentioned the engine blew out a cylinder head, a stop was necessary, and the second section crashed into the first.

President Ledyard says the brakeman went back with all speed, but was too late

General Supt Toucey says the fault was the engineer of the first section did not stop as soon as he should.

No doubt the officials of the road would be glad to lift the burden and the blame from their own, to the shoulders of the men ; that this can be done at will, and is done every day, is a standing disgrace to the laws of the United States

No railroad doing the business, or one-half the business, that the N Y. Central does, has any right to be operated without the block system of signals.

The block, and that alone, is the only safe way to handle many trains running close together. It has its faults, and costs money, but it requires a blunder from two or more men to cause a wreck

The practice of running fast passenger trains over a road on "ten minutes headway" is simply gambling in human life.

A thousand things may come up to stop or slow down the first train, while there might be nothing to check the pursuing monster in the rear. When it comes down to a matter of who is to blame, no honest court of inquiry, composed of disinterested men, would place it anywhere but upon the New York Central Railroad Company. It is high time the railroad men of this country were agitating for laws to make the killing or maiming of every human being upon our railways the subject of a government inquiry.

Alfred B. Ropes, mechanical engineer of the Southern & Central Pacific road, one of the brightest young men in the service, died suddenly at Sacramento, Cal., on the 8th of Oct. A. B. Ropes graduated from the Stevens Institute of Technology, at Hoboken, N J., about four years ago, and then took service in the Brainerd shops of the N. P. road, where he soon pushed himself to the front, and became the mechanical engineer. When Mr Cushing went to the Reading road he took Mr. Ropes as mechanical engineer, and he left there in 1888, to accept a similar position under A J. Small, on the Central & Southern Pacific. That so promising a mechanic should be thus cut off, at the very threshold of a promising career, is a grievous loss to the mechanical world.

The Twenty-Sixth Annual Convention of the B. L. E.

On the 16th of Oct the 26th annual convention of the B L. E. convened in Denver, Col. The opening exercises at the Tabor Opera House were the best and most interesting we have ever listened to, and great credit is due the general committee of arrangements, Messrs. Rice, Hall and McGill

The speeches of welcome from local and State officers were interesting, and the assemblage entertained by an original poem from the engineer poet, "Shandy Maguire," and the presentation of a gavel of petrified wood, made to Grand Chief Arthur by Rocky Mountain Div 186.

As a general thing, speakers on occasions like this take it upon themselves to tell the engineers how brave they are, how noble their calling, etc.; this is especially true of railroad officials We were particularly interested in the speeches of General Manager C F. Meek, of the D., T & G , and of General Supt. J. K Choate, of the U. P We consider their speeches as fair and manly, without taffy, and as representing the ideas of, and the attitude of the best class of railroad officials toward, not only the B. L. E., but all other orders of organized labor The following speech of J. K Choate has much food for solid reflection.

"Mr. Chairman and Gentlemen : I feel deeply sensible of the honor you have conferred upon me, and appreciate more than I can express the kindly terms in which the letter of your local committee was couched, asking me to be with you to-day. Your meeting being in Denver, and in charge of a local committee so largely represented by men serving with and under me, I felt bound to accept You are assembled here for your annual meeting to discuss methods and plans for your own good and advancement, and naturally expect, when you ask an officer of a railroad company to join with you, to get from him some expression of the feelings of the officers and stockholders towards your organization I feel perfectly safe in saying that the good will of all is towards you and with you, and that they are always willing to join in anything that is for your good or benefit, provided it is consistent with good management, Officers of railroads are as a rule always willing to look into your grievances, and to try and right them when presented with good judgment. Great advancement has been made in the past few years in the methods of railway management, and now it strikes me that the most essential requirements of a railway company in its men, is their character, and their personal character, the character of their attainments and abilities, and the character of their organizations; for organizations have their character to maintain as well as individuals. You have all noticed, I know, how well the engineer gets along whose personal character is good. The man who does not drink or keep bad company, who, when off duty, devotes himself to his household and his family, to an improvement of his mental and social condition by study or in reading good books that tend to elevate, who has not the morbid idea that the success of life is to see how little they can do, and how much they can get for it. I don't like a man who wants to be an engineer, and thinks that his aim in life has been accomplished when he is given the fast express to run. I don't like a man who figures out all there is in being an engineer that he must have the best run on the road by being the oldest man in the employ of the company. I like the man who works for his spurs, who says, 'I will show my master mechanic that my heart is in my work, that I will be careful and carry out the instructions, and live up to the rules of the company or my superior officers That I will show him that I know my machinery, how it is constructed, and why it moves. That I will do my work faithfully, and I want to catch his eye by deserving promotion, and that my kite of ambition is flying for the top position with the company.' Now I know promotion comes slowly, from personal experience, but we must all have patience, and try hard, and in the end we will get there. MacKay's words fit the situation exactly:

'If thou canst plan a noble deed,
And never flag till it succeed,
Though in the strife thy heart should bleed,
Whatever obstacles control,
Thine hour will come, go on, true soul,
Thou'lt win the prize, thou'lt reach the goal.'

Much in the character of an engineer depends on courage. I do not mean physical courage, but moral courage, which characterizes the highest order of manhood, the courage to seek and to speak the truth, the courage to be just, the courage to be honest, the courage to resist temptation and the courage to do our duty. Engineers who do not have this virtue have no security whatever for the preservation of any other.

Now, as to the character of the abilities of engineers. As I said before, modern practice in railway management has advanced and improved very much in the past few years. The character of the abilities of engineers must keep pace, and be of a high order. Are we and you giving this enough attention? I know many of you are, but as a brotherhood are you? Think it over and see. In railway management we all work for the same end, and must all pull on the same end of the rope. If we all improve and advance there will be less friction and less liability to disagreement. I hope what little I have said may be of some interest and a groundwork for your thoughts. Choose for your leaders, thinking men and men of character. Don't choose the man who jumps first and thinks afterwards. Thanking you for your kind attention, may I wish you success, and may the objects of your organization, and the precepts of your constitution be fulfilled, and may it be known as an organization by all as one of character."

At the election held Monday, the 28th, Grand Chief Arthur was re-elected for a term of three years, and the national headquarters established at Cleveland. The great question as we go to press is, "Federation or no Federation"

The Swinerton Locomotive Company have had several experts looking over their engine, the "Onward," of late, with a view to demonstrating the superiority of flat spotted drivers over round ones. Mr. M. N Forney has been up looking her over, but we have as yet failed to see any report of the tests, if tests there were, with Mr. Forney's name attached. Mr. Forney's name is worth something, and when signed to a report carries some weight, and it is but fair to presume that, if he were willing to sign a report favorable to the flat driver machine, the company would only be too glad to send it out, as the report is not forthcoming, it is more than likely that Mr. Forney declines to become a flat driver proselyte

The packing rings in the 30-inch cylinder of the P R. R. compound locomotive, three brass ones, were recently found to be broken into several pieces and some of the pieces nearly worn out. The engine has sounded as if her packing was down for some time; she will now, no doubt, show a better fuel economy than ever.

Books Received.

A TREATISE ON STEAM BOILERS: Their Strength, Construction, and Economical Working By Robert Wilson, C E. Enlarged and Illustrated by J J Flather, Ph B

No work on boiler-making has ever been so deservedly popular as the work of Mr. Wilson. It is descriptive, plain and sufficiently elementary for beginners, but it has always lacked engravings and complete adaptation to American practice. Prof Flather has supplied both these brought the work up to date, and placed before the mechanics of the country a reliable work on steam boilers and their fittings. This work is published by John Wiley & Sons, Astor Place, New York The price is $2 50.

ASKED & ANSWERED.

(46) Apprentice, Baltimore, Md., asks:

Why is the link saddle-pin or stud, in locomotives, always set a little out of line with center of link? *A* —See article in this issue entitled, Elementary Lessons on First Principles

(47) I. G B. Aspen, Col., asks

About how much coal is burned per day or trip on the steamships City of New York and City of Paris? *A* —About 330 tons per day of 24 hours, or from 20 to 21 hundred tons per trip.

(48) G M H, Auburn, N Y., asks.

Will a locomotive go faster when the reverse lever is near the center than it will when it is thrown the full length of the rack or quadrant? *A* —Yes, will run faster when working steam.

(49) H. O. Blanchet, St. Johnsbury, Vt., writes.

Would you kindly tell me if that book of "Questions and Answers" to enginemen, by Mr G W Cushing, could be bought? If so, please tell me Mr. Cushing's address, and the price of book *A* —Mr Cushing's address is, Supt. M P. & M, Union Pacific Ry, Omaha, Neb. The books in question were issued free to the employes of the U. P road, and are, we believe, not for sale Preserve them complete in this and the October number

(50) Subscriber, Detroit, asks

1. Are the engines of Class O on the Pennsylvania Railroad fast? 2 What is the fastest railroad record made in the United States? 3. What was the speed of locomotive 1014 on Atlantic City Railroad on its trial? (1) Class O on the P R R. are 8-wheeled, soft coal burners, cylinders 18x24, 60' wheels, and weigh 91,000; they are fairly fast. (2) We do not know what the fastest authentic speed is (3) We do not know that the Reading engine 1014 had a trial; her regular card speed is 49 miles per hour

(51) S W Stahr, Jr., Phila., asks

Can you tell me whether an engineer can reverse his lever when his locomotive is running at the rate of one-half mile a minute, when there is no steam on; and whether he can when there is steam on? By answering the above you will greatly oblige. *A* —The speed is but thirty miles per hour. An engineer can usually pull the lever over at this speed, if the valves are lubricated and the eccentrics not hot or cutting. With steam on, it is harder to handle the lever, but it can generally be done. On some locomotives with extra reach-rods, long-armed tumbling shafts of other unusual designs, it is often very hard, if not impossible, to handle the lever at high speed

Pullman, the City and the Shops.

(Editorial Correspondence.)

The name Pullman is fixed in the minds of all railroad men in connection with that modern convenience and luxury, the sleeping car, and I thought that a condensed description of the great shops and the place where they are situated might not be without interest to railroad men, as they were to me. Less than 30 years ago, Geo. M Pullman built the "Pioneer," the first regular sleeping car; now there are 1,089 in service upon the railroads of the United States, besides some hundreds of other makes of cars following his general plan.

Prior to 1880, Pullman cars were built at the different shops, at Detroit, St. Louis, etc., but the demand for more cars made the establishment of a large central shop necessary, and it was then that Mr. Pullman conceived the idea not only of building a shop, but a city as well. Probably no other place of its size on earth was conceived and built by one man.

Fourteen miles from Chicago a large tract of level land was secured, it was without a single improvement, never had been used and seemed never likely to be, it was so low Here Mr. Pullman has built a city

COMMENCING RIGHT

The history of most towns of 10,000 inhabitants is much the same, there is always the first settler, he usually comes upon the land and rears himself a little house of sod, logs, slabs or any convenient material, he ties his horse to a stake, builds a pig-pen and a water-closet—conveniently near the house—digs his well between them, and proceeds to raise crops, children and malaria Years afterward, the ground is platted into the village, having a Mayor and water-works, and the first citizen and all his neighbors put bath-rooms in their houses, and dig a temporary cesspool in the back yard, that soaks the soil with the germs of disease till the sewers come.

Pullman built his sewers first, not only one system, but two, one to carry off the waters of the elements, rain and snow, which are clean, and a separate one to carry off the sewage of the houses. In every street running east and west there are sewers, every other street having a brick sewer for roof waters, and emptying into Lake Calumet; the other sewers are made of vitrified pipe, carry foul waters to an immense tank holding 300,000 gallons, and located under a huge water tower in the center of town.

The sewage is pumped from it to a sewage farm three miles away, as fast as received, and before sufficient time elapses for fermentation to take place The ventilation of the reservoir is perfect, eight flues lead from it to the top of the tower above it, and a twenty-inch flue connects it with the large chimney, which takes the smoke from the fires under the boilers of the Corliss engine, this flue creates a downward draught in all the manholes in the vicinity of the water tower and in the floor over the reservoir, thus preventing the possibility of any odor from the sewage Standing over the reservoir the visitor never detects anything unpleasant, the air being just as pure as it is in the Corliss engine-room

Thus, before a house was built, a complete sewerage system was in operation

The following facts were gleaned from a sketch written in Spanish for the information of the South and Central American representatives, now traveling in this country, by Mr Duane Doty, the civil engineer of the city, who kindly furnished us with a copy of the translation.

"Pullman is the most remarkable business enterprise of any age, it is the only city in the world built from the first for a city, and on scientific principles, and marks an era in the history of labor, giving workmen far better homes and surroundings than, by their unaided efforts, they could hope to have. Adapting themselves to these improved conditions, their earnings are larger, and their modes of life bettered by being placed upon higher planes. The characteristic features of our time are mechanical industry, and the consequent massing of men in urban communities. This city plainly shows that comfort, cleanliness and delightful surroundings conduce to the prosperity of all, there are no idlers here; all are busy earning money. There are about 5,000 persons engaged in all the different industries, and the pay-rolls are $10,000 a day

Mr. Pullman began building the city in May, 1880, and the first family moved here January 1st, 1881 The population is now about 11,000, and nearly as many more have made homes in its immediate neighborhood With few exceptions the 1,825 tenements here are built of brick, and have good basements are situated upon twelve kilometers, or seven miles of paved streets. Every home is supplied with gas and water, and provided with perfect drainage and sewerage, in other words, with all the 'modern conveniences'

The storm waters from roofs and streets goes through one system of drains into Lake Calumet The sewage from dwellings and shops goes through another and separate system of pipes to a reservoir under the water tower, whence it is pumped to a sewage farm five kilometers distant

The present industries at Pullman are the Passenger Car Shops, the Freight Car Shops, with a capacity for making forty freight cars a day, or one car for every fifteen minutes of working time, the Street Car Works, The Allen Paper Car Wheel Works, The Union Foundry and Pullman Car Wheel Works, with a capacity for using 250 tons of iron a day, The Pullman Iron and Steel Works, rolling 100 tons of iron a day, The Drop Forge Works, which, in addition to their other work, are now making 700 pairs of shears a day, The Calumet Paint Works, The Illinois Terra Cotta Lumber Company's Works; The Standard Knitting Works, and the Pullman Brick Works. Cars of every kind are built for all portions of North America 2,000 Pullman cars are now running on 125,000 miles (or 202,000 kilometers) of railroad.

There are now 50 kilometers of railroad tracks already built for the use of the town and shops, and seven kilometers of street-car tracks. The Arcade is a building 80 meters long, 50 meters wide and 80 high; it contains all the stores of the place, the bank, in which operatives now have about $300,000 in savings deposits, the post office, a theater which holds an audience of 1,000, and a library of nearly 7,000 carefully chosen volumes, a personal gift of President Pullman to the city The library takes 70 papers and periodicals; every one has access to it on the payment of a nominal fee of twenty-five cents a month; 13,113 books were taken from it during the year ending July 31st, 1889. The Pullman Company has no interest in any mercantile business, but simply leases stores to business men.

The water tower, which is 60 meters high, has an iron water tank at the top, holding 2,000 liters of water, it is kept filled for fire pressure only Meats and vegetables are sold in a public market building There are excellent public schools now taught by 24 teachers The very best facilities are afforded for all kinds of athletic and aquatic sports There are now thirty clubs, societies and lodges for social and insurance purposes.

Half the population is American-born; German-born persons come next, and Swedes third in numbers. The population is composite, all European countries being represented in it The lessons taught by this new industrial center are studied and pondered by scientific men, political economists, municipal authorities, capitalists, and students of social science in every portion of the world, and it is everywhere conceded that they have a suggestive value of the highest importance to the human race."

There are flats in the city renting as low as $5.50 per month, all have running water, closets, etc.; the average rent is about $14

The shops are very large, mostly one story but some of the cabinet shops are four stories, where can be seen the fine woodwork of the parlor cars in all stages

Wood-working machines of all descriptions are in operation everywhere, not the least interesting of which are the

CARVING MACHINES

that do the beautifully carved finishing pieces in the car decorations. These machines are simple, the working part being a jointed frame capable of being moved in any direction; this frame carries two spindles running at a very high rate of speed, each spindle holding a little tool not unlike a round-nosed countersink for wood, these tools are exactly the same length, in the center of the frame is a round-headed bar, that is the guide for the other tools, this guide does not revolve, it is guided over the pattern of carved work by hand, and wherever it goes the tools on the ends of the bar each cut out a piece of wood like the pattern, large tools are used to rough out the work and smaller ones to finish it, the smallest finishing tools being less than 1/4 inch in diameter These machines are not sold by the inventor, but rented at $2,000 per year each. As this shop is using six of them, he has a pretty fair income from them alone.

SIZE OF SHOPS

It would be impossible for me to go on and describe these works, they are too big and the paper too small; I saw in the machine shop—which is made up mostly of axle lathe, wheel-boring machines and presses—men turning up axles who were calipering the holes in wheels to make a fit; a system of measuring gauges would seem to me to be a surety of better work. I am not sure that this is the regular practice, but it was being done during my visit

THE CENTENNIAL CORLISS

The great Corliss engine that made the "wheels go 'round" at the Centennial is handsomely housed and cared for here, it was undergoing repairs during my visit, and separate engines doing the work. This great piece of machinery is, no doubt, a good advertisement for these works, but there is no doubt that separate engines located in each shop do the work better and more economically and do not shut down the entire works in the event of a breakdown.

NEW DESIGN OF CARS.

In the shops were two cars as yet unfinished, that bid fair to do honor to their names, "Superb" and "Ideal." They are sleepers, but are entirely composed of state rooms; these rooms can be thrown open, making a central aisle through the car, or closed and locked, an aisle being provided around them. Each compartment is complete, wash-room, closets, etc., they are finished magnificently and each compartment in a different style and color.

FREIGHT CARS.

The freight car shops are the most interesting, here all the rough material goes into one end of a very long shop and comes the other end painted cars ready for the road. The iron work goes into this shop ready to be put up and is sent in car lots; that is, there are just enough pieces to make a car, and the wheels, rods, bolts and nuts are piled along the tracks in the erecting end of shop ready for use; the timber goes from machine to machine on rollers and the machine end of shop pours a steady stream of completed timbers to the erecting tracks. One of the most interesting tools I noticed was one for

BORING A SQUARE HOLE.

The tool was a square piece of steel the size of hole desired and had in its center a round hole in which was located a common bit running at high speed; back of the wings of the bit there were slots through the square bar that let the chips brought back by the bit escape; the point of the tool was concave, like a rivet set, so that each corner of the square tool would tend to bring the wood from the corners to the center when forced into a timber, the auger taking all out. This tool is used to cut the tenons in car timbers, a slot any length being cut by moving the timber along and striking it a number of times.

While I was there they were at work on a large order of huge coke cars for a Pennsylvania Coke Co., and these 60,000 pound cars were coming out of the hopper painted, numbered, lettered, weighed and ready for service at the rate of 40 per day of 10 hours, or one every 15 minutes; this is the every-day capacity of the shop, but 60 flat cars have been built in 10 hours, which is at the rate of one car every ten minutes.

I visited the hotel where many Chicago people board; the bank having on deposit over $300,000 of the savings of these workmen; the library, which the records show is not patronized by the masses as it should be; the office of the *Arcade Advertiser* a lively little weekly edited by Duane Doty, the civil engineer, and came away from Pullman with altogether a different opinion of it than I went there with.

I had understood that the place was run on the store order system, with all the oppression that that system is capable of, but the stores and all business rooms are rented to independent merchants, and the men are free to buy where they can get the cheapest—and Chicago is only 14 miles away. The people seem contented and the wages paid are fully up to the best, the houses are certainly better than could be otherwise obtained, the streets clean, and all surrounded with trees, grass and flowers, that workingmen do not enjoy elsewhere.

H. O. Canfield, of Bridgeport, Conn., has placed on the market a full line of every size and shape of rubber gaskets for steam engine and water work. He makes a class of gaskets for steam work that it takes a temperature of more than 350 degrees to affect, a special soft gasket for water glasses, and all kinds of packing for all purposes.

The Ashcroft Manufacturing Company, 111 Liberty street, this city, who make the Tabor indicator, have issued a little book of 72 pages on indicators and indicating. It describes the indicator, tells how to attach, use and figure, and is, withal, a useful little volume. It is given free to enginemen interested. Write for it.

Editor Debs, of the *Locomotive Fireman's Magazine*, has our thanks for referring men who are seeking *light* to this paper. We get them all, and we want them.

Questions and Answers for the Examination of Engineers and Firemen.

Conclusion

Ques 71 —What is the effect of a small exhaust pipe?

Ans.—To increase the draught from the fire-box, and the passing of air through the grates and fire.

Ques 75 —Can exhaust pipes be made too small for economical working of the engine?

Ans Yes, if made smaller than necessary the power of the engine is reduced in proportion.

Ques 76 —Is it, therefore, desirable to enlarge exhaust pipes to within practicable limits?

Ans Yes; the larger the pipes are the more tons may be hauled or speed obtained by the engine

Ques 77.—In the case of the breaking of an engine truck or tender wheel do you understand how to proceed?

Ans —I should take means to secure the wheel from turning, and in this way make a slide, if possible to do so, and report to headquarters.

Ques. 78 —Do you consider it the duty of an engineer to examine and care for the engine truck bearings and tender journal boxes?

Ans —

Ques. 79 —Have you ever put in a tender brass on the road? If so, how do you proceed to do it?

Ans.—

Ques 80 —In case the rear draw casting on your tender should become broken, what would you do?

Ans —

Ques. 81.—In case a hole should be knocked in your tender, or a serious leak develop suddenly, what would you do?

Ans.—

COMBUSTION.

Ques 1.—Do you understand the subject of combustion in locomotive fire-boxes?

Ans —(Yes or no)

Ques 2.—What elements perform the most important functions in the act of combustion?

Ans —Oxygen and carbon.

Ques. 3.—What is carbon and oxygen?

Ans.—Carbon is the fuel, oxygen the supporter of combustion. Carbon is the fundamental ingredient of all fuel

Ques. 4 —What is combustion the result of?

Ans —The strong tendency that carbon and oxygen have for each other, and their union freely

Ques. 5 What is the result of this free union of carbon and oxygen?

Ans —A certain high temperature combining them very rapidly, with violent evolution of light and heat.

Ques. 6 What is oxygen?

Ans.—An abundantly diffused element in nature Eight-ninths, by weight, of all water is oxygen. Its presence is necessary to life

Ques 7 Where is air, necessary for furnace combustion, taken from?

Ans —The atmosphere.

Ques 8 —What is it composed of?

Ans —One cubic foot of oxygen to three and three-quarters of nitrogen.

Ques 9.—What is nitrogen?

Ans —An inert and neutral gas which does not promote combustion but passes into furnace with the oxygen, and is heated to the same temperature as the other gases

Ques. 10 —If the supply of air is so liberal that there is an abundance of oxygen for the burning fuel, what is the result?

Ans.—The carbon will unite in the proportion of one atom with two atoms of oxygen, producing carbonic acid, an intensely hot gas, and of great value in steam making.

Ques 11 —If the supply of air is restricted and oxygen scarce, what is the result?

Ans —The one atom of carbon is contented to grasp one atom of oxygen only, instead of two atoms, and the result is carbonic-oxide gas, which is not more than one-third as valuable for steam raising, according to quantity, as carbonic acid gas.

Ques 12 —Is the same quantity of fuel used in both cases?

Ans. Yes; the only difference being in the decreased value for steam raising

Ques 13 —How much air is needed, ordinarily, per each pound of coal for good combustion results?

Ans.—About twenty pounds of air per one pound of coal

Ques 14 How much space does one pound of air occupy ordinarily?

Ans About thirteen cubic feet of space.

Ques. 15.—How much coal per hour is used, working ordinarily hard?

Ans About 2,100 pounds of coal is used per hour working hard.

Ques 16.—How much air per minute is needed in the ordinary furnace, working the engine hard?

Ans —About 600 cubic feet of air per minute must pass through each square foot of grate, or about 11,200 cubic feet of air for the whole grate area, averaging 17 square feet

Ques 17 —What does this result indicate?

Ans —That the best results follow only with a proper admission of air, necessitating a clean ash pan and unobstructed passage for air, and the use in fire-box of sufficient fuel only for the purpose desired, viz: perfect combustion.

Ques 18 —Are the volatile gases of value?

Ans Yes; the combination of hydrogen gas, if it combines with eight pounds of oxygen taken from the air, produces about 50,000 heat units, or enough to raise 294 pounds of water to the boiling point.

Ques 19.—Is it difficult getting the necessary large volume of air needed for combustion to the proper place?

Ans Yes; as the hydro-carbons are released at the top of fire some means of admission of air to the surface of fire is necessary

Ques. 20 —Is there danger of heat losses as result of bad firing?

Ans —Yes; an inferior fireman, who maintains a thick fire, will often use up an enormous quantity of coal without making an engine steam freely.

Ques. 21. —How is this caused?

Ans.—By the air failing to reach the 25 per cent. of the fuel that exists as hydro-carbon, and which, in consequence, are wasted, and because, also part of the carbon is burned to carbonic oxide instead of carbonic acid.

Ques 22.—Is there danger of loss in combustion by reason of use of small nozzles?

Ans Yes, nozzles too small will make blast too sharp, and will tear holes in a thin fire by reason of the fierce rush of air, and the fireman will make a thick bed of fire to prevent this, and it often happens that enlarging nozzles will cause an engine to steam better.

Ques. 23 —How will a fireman act who is desirous to work well, and who knows what good firing means?

Ans —He will keep sufficient fire on the grates to suit the engine's working, and enough to prevent loss of air by passing up so freely as to reduce the temperature of the fire-box. He will keep up the fire by using a shovel full of coal at short intervals, and the result will be that most of the gases are burned and very little or no smoke is passed from the stack.

BRAKES.

Ques. 1.—What is your duty regarding air brakes before coupling engine to a train?

Ans.—The air pump is to be started and lubricated for the trip, maximum pressure pumped up with which to charge the brakes, and those which may be set should be released.

Ques. 2.—What is your duty as soon as engine is attached to train?

Ans.—First, charge the brakes; second, apply brakes at full force and hold them on while brakemen or inspectors go over train to make sure that all brakes are set; upon their signal, brakes are released. Then wait for report regarding number and condition of brakes before starting out.

Ques. 3.—How would you start your pump?

Ans.—Would start slowly and increase speed gradually, and thereby not force out the water of condensation, which would be injurious to the pump.

Ques. 4.—How would you lubricate your air pump?

Ans.—I would lubricate steam cylinder with cylinder oil, and air cylinder sparingly with a small quantity of engine oil; would not use tallow or lard oils in air cylinder.

Ques. 5.—What is meant by "automatic air"?

Ans.—The term "automatic air" is applied to the modern Westinghouse system in which the auxiliary reservoir (air storage on cars) and the triple valve come into operation. The brakes are applied by releasing the pressure of air in brake pipe.

Ques. 6.—What is meant by "straight air"?

Ans.—The term "straight air" is used to designate the original Westinghouse system, which operates the brakes by applying the air pressure from the engine reservoir directly through the pipes to the brake cylinders of cars.

Ques. 7.—Does water accumulate in air reservoir and air pipe? If so, what should be done to remove it?

Ans.—Yes; the moisture in the air will condense and accumulate in the main reservoir, which should be drained off once a week in summer and daily in winter.

Ques. 8.—How would brakes be applied in making ordinary stops for stations?

Ans.—For ordinary stops the brakes should be applied lightly, by opening engineer's valve and closing again slowly until the pressure has been reduced on the gauge from four to eight pounds.

Ques. 9.—When are brakes fully applied?

Ans.—Brakes are fully applied when pressure, as shown on the gauge, is reduced twenty pounds.

Ques. 10.—Should brakes be held fully applied until train comes to a full stop?

Ans.—No.

Ques. 11.—Why?

Ans.—Because it causes a reaction in the motion of the train which is very disagreeable to passengers.

Ques. 12.—How can this be avoided?

Ans.—By releasing brakes gradually before a full stop, so that all the air will be off at the moment stop is made.

Ques. 13.—If some brakes are sticking after the train has started, how may they be released?

Ans.—If all the excess pressure has been exhausted, or the amount is not sufficient to release brakes, the engineer's brake valve is put at "lap" and speed of air pump increased; as soon as 15 or 20 pounds additional pressure has accumulated in main reservoir, brake valve is thrown into releasing position, and kept there from ten to twenty seconds. If this does not release brakes the proper signals (two short blasts of whistle given three times) are used, calling attention of trainmen, and they release brakes by hand.

Ques. 14.—What is the maximum air pressure allowed on passenger trains?

Ans.—Eighty pounds.

Ques. 15.—What is the maximum pressure allowed on freight trains?

Ans.—Sixty-five pounds.

Ques. 16.—With a passenger train of from twelve to fifteen cars, what air pressure would you keep the brake charged with, and how would you handle the brakes in making a stop?

Ans.—Would carry from seventy to eighty pounds pressure. In making a stop, would apply brakes gently, reducing the pressure from four to eight pounds, as might be found necessary, and then gradually increase the pressure on brakes until train is brought nearly to a stop, without releasing the brakes more than once. See questions ten, eleven and twelve.

Ques. 17.—Give the different positions of engineer's brake valve handle.

Ans.—First, releasing position, handle against left hand stop.

Second, running position, handle against middle stop.

Third, at lap, handle one-quarter inch to right of middle stop.

Fourth, applying position, handle still further to right. The suddenness of application of brakes depends on distance to which handle is moved to right of middle stop.

Ques. 18.—How much pressure would you carry on a passenger train of two to four coaches, and why?

Ans.—Would carry same pressure for all passenger trains, regardless of the number of cars. Because, with the automatic air brake, each car carries its own reservoir charged with a pressure to be used for a given stop and is therefore subject to the same braking power, regardless of the number of cars on the train.

Ques. 19.—Given a freight train of thirty to forty cars, from five to fifteen of these in front end of train are equipped with air-brakes and can be used to aid in stopping the train, at what pressure would you keep the brakes charged, and how handle the brakes in making a stop?

Ans.—Would carry from sixty to sixty-five pounds pressure. In making stop would apply the brakes gently by reducing pressure from four to five pounds; this will be sufficient to let the cars run together, with only a slight jar on any of them. As soon as all slack is taken up, would gradually increase the force of brakes as circumstances required, being careful to reduce the pressure on train pipe gradually, so as not to use full braking power until absolutely necessary. The object is to gently bring the slack against the air-brake cars, and to hold the brakes on until the train comes to a full stop.

Ques. 20.—Given a full train of freight cars all connected with air brakes, what air pressure would you carry and how would you handle the brake in making a stop?

Ans.—Would carry the pressure prescribed for freight trains—from sixty to sixty-five pounds. In making stop would reduce pressure slightly, just enough to set brakes over entire train simultaneously, and gradually increase braking power until train is brought to a stop, releasing the brake, after once set, as seldom as possible. If the engineer's brake valve be opened wide, allowing the pressure to escape quickly, the brakes on a long train will set on front end some time before those on rear end, causing the cars to jam together with destructive force, then, if the engineer's brake valve be closed quickly, without giving time for the pressure to become equalized throughout the entire train, the forward brakes will become released, resulting in a severe jerk that will, perhaps, break the train in two. In any case, the use of brakes so released is lost. Failures to observe this rule have been a serious cause of accidents.

Ques. 21.—Give essential points to be observed in holding a train of air-brake cars while descending heavy grades.

Ans.—1. Have train charged with maximum pressure before bringing brake into use.

2. Regulating the force of brakes so as to maintain a regular and steady speed of train, also make as long a distance as possible in each application of the brakes. By doing this the pressure is used economically, and the pump is given more time to accumulate the necessary pressure for recharging.

3. Always keeping brake valve in releasing position while recharging, thereby giving the brakes the greatest advantage in recharging quickly.

4. Making no new application of brakes until the full amount of pressure consumed in previous application has been restored.

5. Reducing the pressure as shown on gauge not more than fifteen to twenty pounds from one recharging to another, as it would be difficult to replenish the full amount in so short a time. Moreover, when the pressure, as shown on gauge, has been reduced twenty pounds, the brakes have been fully applied, and any further reduction is a waste of pressure.

Ques. 22.—What is the object of the pressure-retaining valve?

Ans.—The object of this valve is to hold a portion of the pressure in brake cylinder, while the brake is being recharged when descending heavy grades.

Ques. 23.—What are the two positions for handle of the pressure retaining valve, and what is action of valve in each?

Ans.—1. Perpendicular, handle of valve is turned down; this allows the entire pressure to escape from brake cylinder when brake is released.

2. Horizontal, handle is turned up; this retains a pressure of ten pounds in brake cylinder, but permits all pressure over that amount to escape when brake is released.

Ques. 24.—When "double-headers" are run, by whom and how should air-brakes be used?

Ans.—(a) By head engineer alone; second engineer closes stop-cock in train pipe under his valve, or, in absence of this stop-cock, he places engineer's valve in the "lap" position, in order to give forward engineer complete control of brakes.

(b) Second engineer also keeps his air pump working, and thus has air pressure ready for any emergency, such as failure of air pump on forward engine, in which case forward engineer proceeds as second engineer would in (a) above.

Ques. 25.—Would this apply in cases where "helpers" are used for a short distance only?

Ans.—No.

Ques. 26.—The second engineer having assumed control of the brakes, how long should he retain charge of same?

Ans.—Until the end of the trip, except in a case of necessity, which may again reverse the operation.

Ques. 27.—Is it proper to make any experiment with the brakes when on mountain grades?

Ans.—No; this must be done at other times.

Ques. 28.—What should always be borne in mind when on mountain grades?

Ans.—To keep train well under control.

Ques. 29.—Should descending at high speeds be practiced?

Ans.—No.

Ques. 30.—Why not?

Ans.—Descending at high speed must not be practiced with any train, for there may come a time when some part of the machinery may fail, and, while practicable to control speed by hand brakes at eight to ten miles per hour, it may be impossible at twenty to thirty miles per hour to regain its control.

Ques. 31.—Are you familiar with the use of driver brakes on locomotives?

Ans.—

Ques. 32.—How do you apply them?

Ans.—I apply the brakes gradually in order not to bring a too sudden strain on the brake rods and lever.

Ques. 33.—Would you reverse your engine when driver brakes are set?

Ans.—I would not.

Ques. 34.—What would be the probable result of reversing engine with driver brakes set?

Ans.—The effect would be to lock and slide the wheels, resulting in flat tires.

Ques. 35.—In case of failure to any part of air or driver brakes during the trip, what would you do?

Ans.—Report it promptly to master mechanic or foreman for inspection and repairs.

Ques. 36.—What extra air brake parts should you always carry on your engine?

Ans.—I should always have on engine one extra hose for connection between engine and tank, and one hose for between tank and car.

The *Frog*, of Denver, has enlarged, doubled its size. Seems like a pretty healthy toad.

Talk about railroad men not wanting to keep posted up on the new devices pertaining to their business, which manufacturers are all the time bringing out! Some time ago H. K. Porter & Co., of Pittsburgh, put an advertisement in THE LOCOMOTIVE ENGINEER, and about half a dozen other papers, asking interested readers to send for their new illustrated catalogue containing useful information about light locomotives. A man, who was present at the inquest, tells us more men wrote referring to this paper, than to all the rest put together, and the letters were from the right kind of men, too. The other day the Vance Tube Cutter Co., of Geneva, N. Y., wrote the publishers of this paper: "We are having very good results from our LOCOMOTIVE ENGINEER advertisement, and feel perfectly satisfied with your publications as an advertising medium." Now the Mason Regulator Co., of Boston, come upsmiling, and say they are "hearing from their card in THE LOCOMOTIVE ENGINEER from all over the world." Just wait till we get into long pants!

On a recent visit to the Meadows shops of P. R. R., we noticed that connections had been tapped into the three cylinders of the Webb compound locomotive and "pig-pens" built to keep the men on. They were also making indicator connections on one of the new class "P." A comparison of their work would be very interesting indeed. The indicator connections were, of necessity, tapped into the heads of the low-pressure cylinder, but the practice is not considered the best, unless the pipes are large and without bends, it is followed in the case of high-pressure cylinders as well. The compound begins to look hard, is dirty, and has the general appearance of a tramp without friends.

We have noticed on some roads where air pumps were overhauled, that the pump man has tried to make an improvement by making the top of packing-nut on air cylinder cup-shaped, thus preventing the water and oil from running down over lower end of the pump. The cup is a bad thing, for it collects the water condensed from the steam that leaks past steam piston packing, and holds it around the rod, right in shape to be sucked down into air cylinder when the piston is on the down stroke, we all know the disadvantage of having water collect in the pipes and the drum.

The new shops of the Mason Regulator Co., at Milton, Mass., are completed and occupied. These shops are 34x80, two stories high, and all windows. The shops were designed by Mr. Mason himself, and were especially fitted up for their specialties—pressure regulators, damper regulators, reducing valves, etc., and as the shops and the tools were designed to make a specialty, they are enabled to turn out a large amount of duplicate work. They are especially busy now on reducing valves for car heaters.

During the busy hours, trains on the Brooklyn bridge actually overlap one another. Before the passengers leaving the depot from one train are clear of the platform, they are joined by those of the train following. It is only a matter of a short time before the present crowded accommodations will be inadequate, and the enlargement of the depots and approaches to admit of the arrival of a four-car train every forty-five seconds is now under consideration.—*Safety Valve.*

The Baldwin Locomotive Works are turning out twenty-eight locomotives a week. At this rate they will build 1,456 during the year.

Cylinder Boring and Facing Machine.

Made any size required. Will bore cylinder and face off the ends at same time. Built strong and powerful; has variable feed that feeds either way.

BORING BAR for LATHE.

Has Hardened Steel Centres. Constant Feed of Cut Gears. Steel Feed Screw and Nut. All bars accurately ground, and are first-class. All Sizes Made.

PEDRICK & AYER,
MANUFACTURERS OF
Special Tools for Railway Repair Shops
1001 & 1003 Hamilton St., Phila., Pa.
CIRCULARS ON APPLICATION.

PORTABLE CYLINDER BORING MACHINE.

For boring IN THEIR PRESENT POSITIONS all makes and sizes of Steam Engine Cylinders, Pumps, Steam Hammers, Air Compressors, Mining and Hoisting Engines, Heavy Housings, Large Wheels, etc. Machines made any size required.

Greenwood's Universal Planer Chuck.

For Straight, Curved (Concave or Convex), or Angle Work. Used on any Planer with Cross-Feed for Links, Wedges, Keys, etc. Indispensable for Locomotive Builders and Master Mechanics.

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STANDARD STEEL CASTING CO.,
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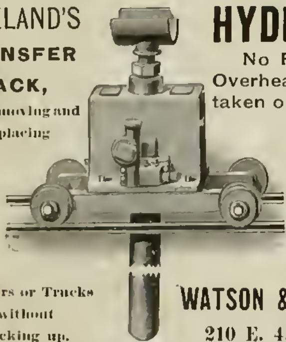
For Removing and Replacing



Drivers or Trucks without Jacking up.

HYDRAULIC TOOLS FOR RAILROAD WORK

No Floor Space required for the Vreeland Transfer Jack. No Overhead Tackle. No Blocking. No Danger. Drivers and Trucks taken out in less time than it takes to jack Engine up.

IN USE ON 10 RAILROADS.

HYDRAULIC JACKS,
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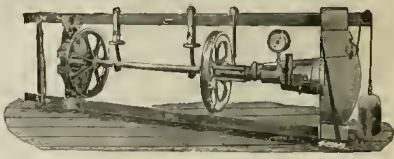

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FOR SMALL SHOPS.

JENKINS BROS.' VALVES.

E very valve tested and warranted, all parts interchangeable.
N othing but best Steam Metal used in the manufacture.
K eyed Stuffing Box and Disc Removing Lock Nut
I s used only in the Jenkins Bros.' Valves.
N one are genuine unless stamped with "Trade Mark."
S hould you order INSIST on having Jenkins Bros.' Valves.

71 JOHN ST., NEW YORK
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SELDEN'S PATENT PACKING.
With Rubber Core for Steam.
With Canvas Core for Water.

Try it on your Hydraulic Work.
Try it on your Westinghouse Air Pumps.

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SOLE MANUFACTURER,
38 Cortlandt Street, New York.

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FROM 1-4 TO 15,000 LBS. WEIGHT.

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Stronger and more durable than iron forgings in any position or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
Crossheads, Rockers, Piston-Heads, etc., for Locomotives.
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IS THE
BEST BOOK IN PRINT
FOR LOCOMOTIVE ENGINEERS AND FIREMEN.

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Address S. A. ALEXANDER, York, Pa.

ROSS REGULATOR VALVE
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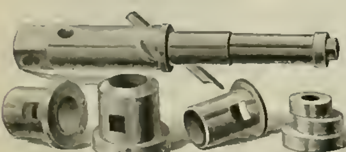

For removing Flues from Locomotive and Stationary Boilers. One man can cut five hundred (one end) in a day. In use in the leading Railroad Shops of the country. Combination Cutter for removing 2", 2¼", 2½" and 3 inch Flues, $50. Sent on approval to Railroad Co.'s. Liberal Discounts to the Trade.

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Every Engineer, Fireman, Conductor, Brakeman, and Baggage-Man, to send 6 cts. in stamps for Sample Copy of Eaton's R. R. Time Book, also Terms to Agents. Address,

FRANK EATON,
LYNDONVILLE, VERMONT.

TOOLS FOR LOCOMOTIVE BOILER WORK.

The Cut shows our
PATENT PLATE BENDING ROLLS.
Specially adapted to this work.

The HILLES & JONES CO., M'frs.,
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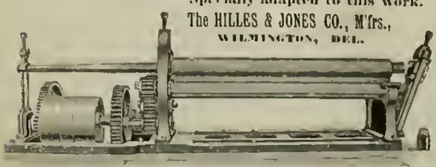

Represents all sizes that are driven by belts.

It is but the work of a moment to balance the top roll and lower the hinge housing to take out the plate when a full circle is bent. The rolls are all made of solid wrought iron, the balance bar being a part or extension of the top roll. There is a cast-iron bed-plate under the entire machine. To save any shifting of belts we put in Friction Pulleys which enable the rolls to be started, stopped or reversed instantly.

THE GLACE LOCOMOTIVE CHECK VALVE.

Three Separate, Distinct and Independent Valves in One Case, Insuring Freedom from Sticking, and obviating difficulties experienced with old-style single valve.

POPULAR WITH ENGINEERS
Wherever Tried.

J. E. LONERGAN & CO.,
MANUFACTURERS
Locomotive Pop Safety Valves, Guide and Rod Oil Cups, Railway Brass Goods, etc.
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THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. II, NO XII. NEW YORK, DECEMBER, 1889. 1.00 per Year or 10c. a copy.

A Stylish Locomotive.

When Mr. William Hoffecker became Superintendent of Motive Power of the Central Railroad of New Jersey, about a year ago, he began at once to discard the Russia iron covered and fancy-capped straight stack for a very plain one, jet black, and the veriest excuse for a bead around the top. They were cheaper, easier repaired and just as good, but the engineers did not like them very well—they were not pretty in their eyes.

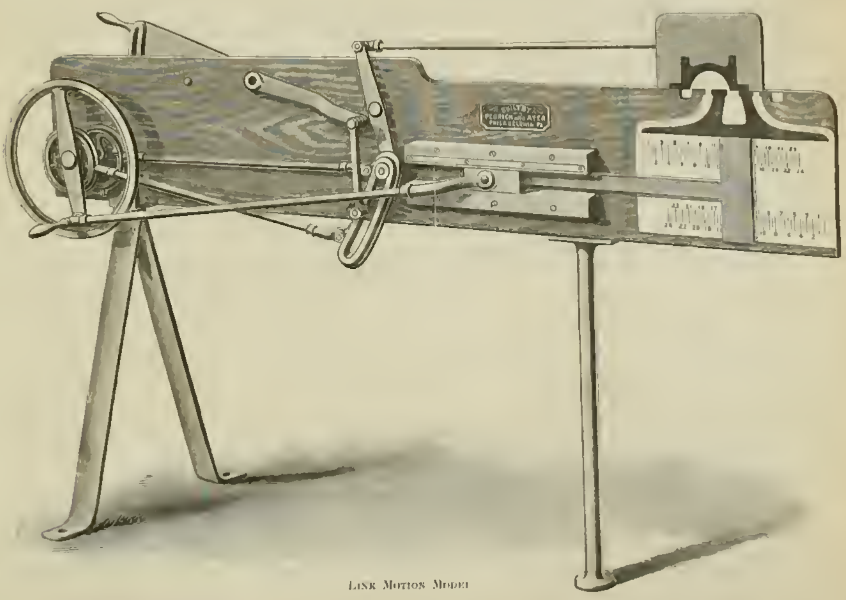
They tell a story over there on one of the engineers, whose engine was about to go into the shop and who hoped that he would not get one of those stacks.

Mr. Hoffecker asked him if he had seen the 147, and how he liked her. He got the following reply:

"First class, she is a mighty nice looking engine. Do you know, she reminds me of a young, handsome, stylish lady, russet leather shoes, striped stockings, satin dress with low neck and short sleeves, pink sash, red corsets, silk suspenders, diamond earrings, and a darned, old, dirty calico sun-bonnet, with pasteboard slats in it."

Locomotive Link Motion Model.

Ever since the establishment of THE LOCOMOTIVE ENGINEER it has been giving voice to a very large class of engineers and firemen, who are attempting to help themselves to a more thorough knowledge of their business, and among the first demands was one for a cheap, yet accurate, model of the valve motion of a locomotive; excellent models were in the market, but they were designed more for the drafting-room than for the lodge-rooms of men on the road, and cost well up in the hundreds of dollars.



LINK MOTION MODEL

After considerable thought on the subject, and the failure of many attempts to get some one to put such a device on the market, the editor of this paper and Mr. Fred J. Miller, associate editor of the *American Machinist*, designed the model illustrated on this page, which is being manufactured and introduced by Pedrick & Ayer, the well-known railway tool builders, of Philadelphia, Pa.

No attempt has been made to get up any improvements or to make the model different or better than the motion under any engine. On the other hand, every effort has been made to make the model as near like an every-day locomotive as possible, each part occupying the same place as on the machine itself. The model is just half size, every measurement, but diameter of the driving wheel, being taken from a standard, 17 x 24, 8-wheeler.

The entire motion, wheel, main rod, valve, cylinder, piston, link, hanger, eccentrics, etc., are arranged on one side of a solid frame that admits of the whole motion being watched from one point and by a lodge room full of men.

The frame, piston and guides are made of wood, all the working parts are of iron or brass, well fitted and stiff for the work they have to do. The main rod, valve stem and eccentric rods are made of polished brass tubing, the eccentric rods having right and left-hand threads, so that they can be easily adjusted to the right length, they are held at any point desired by knurled nuts on each end. The eccentrics are held on by set screws, and can be moved, to practice in setting them. The valve and the ports are painted on the frame, and can be changed by simply tacking cards over them with different dimensions on them.

On the cylinder there are two scales, one number-ing from either end, so that the position of the piston can be noted for the cut-off, exhaust, or any other position of the valve. There is no reverse lever to be out of order or to mislead as to the point of cut-off, the link is raised and lowered by raising or lowering a fan shaped counter weight that is attached to the tumbling shaft, and extends toward the wheel on the back side, if it is desired to set the model to cut off at a certain point, the crank (which is an extension of the main pin) is moved so that the piston uncovers the figure that represents the point of cut-off wanted, the lever behind the board is then moved just so that the valve is closing the port, and then fastened by a thumb screw, this makes the lost motion take care of itself, as every time the lever is set for a point of cut-off it is set by the piston itself, and not by a quadrant that may be "out."

On the back of the valve there is a device—not shown in the cut—that makes an audible snap at the moment of exhaust, this is adjustable, and can be used to denote the port opening, cut-off, or any other position of the valve, but is intended to show the exhaust, as the men are used to hearing that—a student can be watching the position of other parts, the link or eccentrics, and still note the time of exhaust.

The wheel has but two spokes, so that the eccentrics are easier seen. On the back of the axle there is a crank that can be used to turn the model when it is desirable to give an entirely clear view of the whole device in motion. The rim of the wheel is turned up true, so that accurate measurements may be made on it in getting the dead center. On the frame ahead of the wheel is an iron pin with a center in it, so that a correct point to tram from can be had without marking up the machine; there is also one on top of the frame just back of the valve to tram from in setting valves. On the guide there is a strip of brass to scratch on in getting measurements. There is a steel tram furnished with the machine for making these measurements.

Complete directions for setting up the model, measuring to get the extreme of dead center, setting eccentrics, setting valves, etc., will be sent with each machine.

The model is a little over six feet long, stands about four feet high, and will weigh about seventy-five pounds, it is neatly painted or polished, and has the appearance of a machine, and not a toy.

The aim of the designers has been to make this model just as adjustable as a locomotive's motion is—and no more. It will be found to contain all the points of advantage and all the faults to be found in average practice. It was designed to teach the principles of link motion, and will, we think, be found of great value in lodge rooms of enginemen, reading rooms, and in railroad offices where engineers and firemen are examined.

There is a spirit of progress growing in the country, and railroad officials cannot do better than to help their men to such devices as this. The want of a little knowledge of the inside of a steam chest or cylinder by a man in charge has cost many a railroad more than a hundred times the cost of this model, that might have made it plain to him. The price is low enough for the poorest lodge or the average engineman.

On a recent trip over a part of the U. P. Ry. we enjoyed a ride on locomotive 824—an eight wheeler, built by the company. The engineer informed us that she had been in service three years last February. She was pretty lose generally, especially the cab and running boards, but she had balanced valves, and they had not been faced during this time, or the eccentric straps closed. The lever handled easily, and the motion work showed little signs of wear. This alone should be more than inducement enough for a thorough trial of balanced valves where they are not now known.

Don't use emery to grind in brass cocks, it imbeds itself into the soft brass, and keeps on grinding itself out of true after the cock is put in use. Use grindstone grit, this cuts brass well, and will wash off by using water.

None so Blind as Those Who will not See.

It is curious how some men can look at a thing and not see it. A member of the examining board of an important railroad recently told the writer that they found a great number of men, engineers, firemen, and trainmen, who did not know there was a difference in the *shape* of the red and the white signal boards at all telegraph stations.

The white, or safety board, is square, and has a square hole in it, while the red, or stop board, is round and has a round hole in it—if a man is thoroughly familiar with the shape, it is perfectly safe for him to run by the board if it is covered with sleet or snow—the *shape* tells him what it is.

How any man can fail to note a thing of this kind, when he sees one at every station on the road, is obliged to look at it, and his life depends upon every look, is more than we can see.

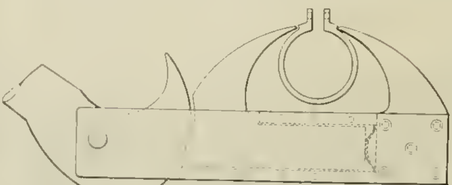
Look about you, notice things, think about them and don't be blind.

A Record for Repairs.

The Pueblo Smelting and Refining Co., Pueblo, Col., own and operate two, six-wheeled, saddle-tank ponies that have done a remarkable amount of work for the repairs they have received. They have been run pretty hard, sometimes double crewed, and one of them ran five straight years without having her valves faced—she has the Richardson balance.

They have solid ends on their main rod fronts, and these ran the same length of time.

Master Mechanic Jones has recently rebuilt these little engines, and found many parts that would naturally be supposed to be badly worn, were not so bad as to need repairs. No running repairs are done on them, except what the engineers do, and they have no machinery or tools, and only a shallow pit under a shed to work in.



HOSE CLAMP HOLDER.

Hose Clamp Holder.

At the Denver shops of the Rio Grande road we noticed a little device for forcing the clamps on air hose together, to enable the operator to insert the bolt and secure it by a nut. The frame, jaws, and lever are made of ½ inch iron, the end jaw being riveted fast, the jaw next the lever being loose and sliding freely between the sides of the frame and the strips riveted between them at top and bottom, a spring at the end will slack this jaw off when lever is released. The end of the lever can be made any length or shape desired, and the device can be held in a vise, or the frame extended to bolt upon a bench.

We are under obligations to Ben Diggory, traveling engineer of the Denver & Rio Grande road, for a copy of the new instruction book, recently issued by N. W. Sample, Supt. of M. P. & M., governing use of air brakes and Baker heaters. The book is in the shape of questions and answers, and is conveniently divided into general instructions to all, instructions to enginemen, instructions to trainmen and to car repairers. The D. & R. G. was one of the first if not the very first, to adopt the air brake for all freight service—they do not own a car not equipped with air—and Mr. Sample ought to know what is needed in the care and handling of air-brakes.

The P. R. R. compound recently broke the piston head in her big cylinder.

The Traveling Engineer.

BY J. E. PHELAN.

LAST PAPER.

Among the most agreeable experiences of the traveling engineer can be named pleasant dealing with master mechanics, who are ever ready to receive reports of defective machinery, and always willing to remedy the same.

The prime element in successful work, for either the traveling engineer or master mechanic, is constant watchfulness and properly locating defects, with an ever present and active determination to remedy fault, while maintaining proper discipline, and keeping machinery and engines in thorough repair for effective service on the road.

We have known master mechanics who always had their engines in first-class shape, on paper, *i. e.*, never failed to report the condition of engines to the general office as first-class, regardless of the miserable condition of the engines in actual service.

Dealing with such talent (?) gives the traveling engineer his most distasteful and most disagreeable experience.

However, under such circumstances, there is but one course to pursue, and that is for the traveling engineer to tell the truth about the condition of the engines, and report the same to general officials, and let the misguided M. M. paddle his own canoe.

After watching the progress of individuals in official position, one can realize that the official who ever stands ready to remedy defects generally gets through his duties with a fair measure of successful results, while the men who are incapable of discerning right from wrong soon sink to proper level, and, though lost to sight, stand as a beneficent example to the errors of false practice.

The traveling engineer who can gain and uniformly command the respect and good will of master mechanics, and engineers and firemen, with whom he associates, can count on a happy pathway through the field of duty.

Such good will can be gained by uniform truthfulness and square dealing—*i.e.*, by treating all men alike, and having no friends to reward, or enemies to punish.

In any event, when consistent, be fair with your friends, and let your enemies take care of themselves.

When you find engineers or firemen not fully competent, and not thoroughly posted regarding their duties, do not be hasty in condemning them. Do not form prejudices in advance of the verdict of intelligent judgment.

Never condemn any one until fully satisfied beyond any measure of doubt that the retention in service of parties at fault may lead to demoralization of the service, or be disastrous to desirable and successful results.

The traveling engineer possessing that happy gift of nature, capable of discerning true merit, wherever found, and giving full measure of credit to the same, regardless of personal prejudice, or bias of association or nationality, can be relied on to attain successful results, and reflect credit and confidence around all with whom he may come in contact.

Our readers must not assume that we are reaching after ideals; for we know such principles are in practice at the present time, and carried out successfully by traveling engineers in active service.

Traveling engineers who do business according to such principles can afford to bear the criticism of a few while being supported by the confident sentiments of the majority.

We have known men to criticise traveling engineers for showing up on the road after night fall. We can hardly recognize the necessity for traveling engineers going to bed at time set by chickens, simply because a few chronics are disposed to growl.

A clear conscience will go a great ways toward warding off effects of criticism, as well as rendering similar criticism scarce.

At the present time, the innovation of a traveling fireman is becoming quite popular on certain railroads, and, from evidence at hand, proving a successful experiment.

For our part, we cannot see why such a practice, honestly and skillfully executed, should not be most beneficial to general service.

A locomotive engineer cannot be considered thoroughly competent, unless fully versed in the art of firing.

Successful and skillful firing means dollars in profit to railroad management, when economy in consumption of fuel and supplies is fully considered.

It stands to reason that an instructed fireman, becoming efficient from competent direction, commences building on a proper foundation, and can more readily comprehend further instruction after becoming an engineer.

However, knowing how an incompetent engineer can render successful results from skillful firing impossible, the query is, "What authority has the traveling fireman over the incompetent engineer?"

We know, however, that the successful traveling fireman of to-day will make the successful traveling engineer at some later period, and we wish to add words of cheerful encouragement to all worthy characters laboring along the path of progress.

In closing our extended and rambling remarks on this subject, we want to say to our associates, whether traveling engineers or traveling fireman: Be ever faithful and diligent in enforcing rules and doing duty. Be uniformly consistent and fair with your associates on the road, and with the management employing you—but don't do any detective business, never sneak or crawl, but always stand out openly and aboveboard; be manly.

All know how much annoyance and expense is caused to them by the breaking off of oil-cup shanks, but few have stopped to consider the total cost from this little thing alone. We have before suggested the use of a steel shank, but this is open to one objection—it can rust fast in the strap. On the Denver & Rio Grande road they screw a steel plug into the rod strap, and put a very large hole in the top of it, and a correspondingly large shank on oil-cups, the cups set up higher, but are stronger and not in the repair shop so often.

Did you observe that this issue is composed of twenty pages instead of sixteen, and the index extra. A steadily growing subscription list, and a list of liberal advertisers make enlargement necessary. It is our aim to give just about three times as much reading matter as we have advertisements. You thus share in our prosperity in receiving more meat for your dollar.

A Pennsylvania Passenger Engine.

Since we published an account of some of the changes in the class "P." engines of the P. R. R., in the October number, we have had many requests to "show them up, and let us see what they are like." The P. R. R. are not willing to let much of anything be shown—did not want to let us show up the compound—but we did all the same. Our readers have called for a cut of the new class "P.," and here it is, taken from a photograph—caught on the fly by Albert E. Bruen.

For part of the details we refer our readers to page 3 of the October number. This engine has the Belpaire boiler—square top. Two hundred and ten flues, two inches in diameter, with the fire-box end swaged down to an inch and a quarter. The pops are incased in the device on the wagon top, into which the whistle is tapped. The dome is ahead of the fire box and contains nothing but the throttle. The sand-box—like all P. R. R. engines—is in the front wheel cover, and out of sight. The engraver has shown the steps on the tender as well as on the engine; they are large and strong.

The Arbell or Belgian wrought-iron wheel is used on the front trucks; they are forged in one piece, with steel tire shrunk on; they appear of very light

A PENNSYLVANIA PASSENGER ENGINE.

section. Just below the stack will be noticed a lever on the smoke arch; this is a muffler to throw over the exhaust nozzle when in depots and around stations. There are two air-drums arranged side and side; this is a good thing, as it provides a large volume of air to draw from and does not rob the drum so much in re-charging, allowing of a more even running of the pump.

These engines are unhandy in the cab, crowded, and uncomfortable, and are therefore not likely to be popular with the men who live on them, but they all say they are pretty good engines, steam well and handle their trains easily. They are 18½ x 24, 68-inch wheel, hard coal burners, weighing about 105,000 pounds ready for the road, and carry 160 pounds of steam. The excellent engraving tells the rest of the story.

Some roads in the country still use the old-fashioned "chair" under the ends of rails. The rail splice, then the angle bar, supplanted them. Now comes a new device, that is a combination of the chair and splice, which reminds us

In 1848, Isaac Dripps made some splices for the old Camden & Amboy, that had a bolt through the splice bars and the end of each rail, and was spread out under and at the sides of the joint, to receive the spikes. The bolted splice did not supplant the chair for fifteen or twenty years after this, however.

A Special Machine for Paper Wheel Work.

At the Allen Paper Car Wheel Works, Pullman, Ill., there is in use a very ingenious machine for removing the nuts and bolts that hold the plates and web of old wheels together, and for putting the bolts into new wheels.

The wheels are swung between two cones entering the bore, these cones are on sliding heads that can be moved in and out to adjust the different rows of bolts in position to be operated upon.

On either side is located a small steam cylinder, the one on the side of wheel where bolt-head is has a hollow head on the piston, and the movement of a small lever throws it solidly against the web of the wheel and over the bolt, the other cylinder piston striking a blow that drives the bolt out.

In putting up new work the operation is reversed, the other piston acting as an anvil to drive against, and the head end piston driving the bolt.

By running the wheel carriage across the frame of the machine, the row of bolts is brought in line with two chucking heads; one holds the head of the bolt, and another, revolving, screws on the nut.

How do you like the appearance of 20 pages at the old price for 16?

Originality.

The editor has to thank the many friends who see that he gets "comps." invitations and tickets to all the brotherhood balls from one end of the country to the other.

There have been no poor ones, but the most original and unique comes from Fargo Lodge, No. 85, B. L. F., at Fargo, North Dakota. The invitation is printed in script, on yellow manifold paper, in the shape and language of a train order. Let it tell its own story.

Brotherhood of Locomotive Firemen, }
Fargo, Thanksgiving Eve, 1889. }

ORDER No. 11.

TO YOURSELF AND LADIES:—Run from your home to Armory wil'; dance between 8.30 P. M. and 3.00 A. M. to music by Rupert's orchestra, meet Ehrman with refreshments at 12.00 A. M. Flag against long trains; approach crossings with caution, and look out for another party following next year. Be particular to enjoy yourself.

FARGO LODGE, No 85, B. OF L. F.

Order No. 11 O. K., 8.30 P. M.
85 B. of L. F., by
Eugene McAuliffe,
C. M. Conroy,
J. W. Beebe,
Committee of Arrangements.

If you think you can help extend the circulation of THE LOCOMOTIVE ENGINEER send for club rates; it will pay you for your time.

Correspondence

Exchanging Kinks—A Piston-Rod Remover.

Editor The Locomotive Engineer:

I have been an interested reader of your paper for the past year, and take great interest in it.

I would be pleased to divide some of our shop experience with readers of your paper, and send you enclosed a blue print of a very practical device for removing the piston-rod from the crosshead.

The tool has been in use for some time, but was improved by A. Bardsley, M. M., and his machine shop foreman, so as to be applied to all classes of engines, especially to moguls, as they are more in use here. The print will give any practical mechanic a clear idea of its use.

The front end of main rod is to be disconnected, remove plugs *B* and *C* from device, take the tool in one hand and put it between crosshead sides, so *D* will point to center of piston rod, screw *B* from the outside of wrist pin hole, *C* from the inside of the same, and apply the power as indicated by *H* and *G*. The large piston to move up quickly, the smaller one for power.

A flue sheet cutter, you referred to in your September issue, I have improved to drill 200 holes in 10 hours, blue prints and description for which I will send you at an early date.

O. G. Burrish.

Brainerd, Minn.

The Trials of an Inventor.

Editor The Locomotive Engineer:

When I was coming home from the convention, traveling, as is my custom, *incog.*, a bilious-looking delegate, who was working his way homeward in the steerage, took a farewell munch, as we approached the Missouri River, of a cold lunch he had got together at the banquet—he threw the last bone out of the window, wiped his mouth on the tail of his Prince Albert, and covered my feet with the paper that had held all that was mortal of the late lamented hen turkey, and sadly left the train at Omaha. When he was gone I picked up the paper and read it. It had been amputated from an alleged railroad paper, and contained advertisements only. Among the rest was one for a wrench that registered how much strain there was being applied to a bolt. I threw the old scrap away, but all the evening I kept thinking that I had seen an old, familiar face, some friend long since gathered to his fathers—I was haunted. Along toward morning, the engineer used the emergency clause on the Westinghouse to stop at a tank, and I changed seats with a Swedish emigrant who was trying to sleep on top of a tin trunk in the aisle, I butted my head against an iron seat—and it all came to me. I am the father of that idiot notion myself.

It was away back in the tail end of the fifties, or the fore and front of the sixties that I—then a boy in knee pants and my teens, first got a job of running—it was from the fire-door to the tank. It was on a New England road that wandered off in an aimless and westerly direction from the good city of Boston, and the general manager was an old friend of the family.

I never knew what put it into my fool head, but that registering wrench racket struck it hard; I thought it a grand idea—remember I was terribly worried least some one should find it out and get ahead of me—I wish they had. After burning the midnight oil and my new and tender mustache, during a whole winter, I at last produced a wrench that was fearfully and wonderfully made; it was one of those combination abominations, and the register was the striking feature about it. It was so arranged that its adjustment to a nut would move a gauge that would admit of only so much pull on the handle—according to the size of the nut. I decided that, say, ten pounds was enough pressure to apply to the nut of a one inch bolt. I set the spring so that is all the pressure that can be applied. I figured out a great saving in not breaking bolts as well as in wrenches by applying the proper pressure. I got the advantages all down fine, and then took it up and laid the whole thing before the "old man," the General Manager.

He looked the whole thing over carefully, and offered to pay for the patent and introduce it on the road for half—I agreed. The patent came along in due time, and we had a couple of the wrenches made in the shop—company expense. The engineer I was firing for got one to try, some machinist the other.

The first time old Paddy O'Wing took that wrench down, he screwed it out to fit the two-inch base of the rod-cups, and twisted two of them off trying to get pressure enough on the wrench to bring the indicator up to the scratch—the fool did not take into consideration the size of the stem on the cup—said the wrench was supposed to figure on that, and that I had made my brags that any numbskull could do as nice work as the best mechanic, if he only used the great and only wrench.

When I got in the G. M. sent for me. I remember now how I wondered if the old skinflint was going to try and buy me out for a song, or was just going to tell me that he had got an order for thirty or forty gross of the great and only, John Alexander, perfection, registering wrench. After I got seated in his office, he turned on me and said:

"How did that wrench go?"

"Well, only middlin'," said I, and then I had to tell him how it fared at the hands of old Pat.

"Your inventive genius has got the whole shop shut down here, Mr. Alexander," said he.

"How's that?" said I.

"Well," said he, "the watchman washed out the shop boiler last night, and put in the wash-out plugs with that measly wrench of yours; the plugs are about three inches at the thread, and are turned in by a square end about three-quarters of an inch in diameter; they turned them in as hard as that wrench would let 'em, and when they got up about twenty pounds pressure, one of them blew out, broke fourteen lights of glass, cleaned out the shop, cooked all the paint off two tanks, the meat off the foreman's leg and burned the boiler to boot."

This sort of staggered me, and the old gentleman wrote a few minutes while I thought.

"You forgot something, Mr. Alexander," said he.

"What is that, sir?" said I.

"To furnish brains to use with that wrench," said he, commencing to write.

"Or use any in its construction," continued he.

"Yes, sir," said I.

"You don't know much about wrenches, sir," said he.

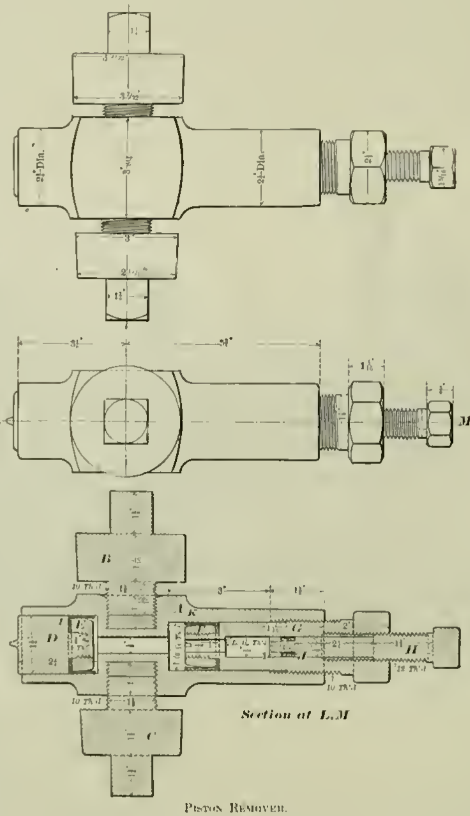
"Not much," said I.

"You may go now, sir," said he, "and don't let me hear any more about your great inventions, sir, you are a fool, sir, a fool!"

I made for the door, and as it closed behind me I heard that old sinner saying: "You are an ass, sir, a dommed idiotic ass."

That wrench was a sore place in my life for a long time, but I lived it down, and I want to say this to the young mechanics who are figuring to invent something: Don't waste any time on anything that is not a simpler and cheaper way of doing things than that in vogue in the practice of your road. Don't try to invent anything that tries to put brains into the head of any one, or that expects to accomplish much by putting skilled work into the hands of those not trained to that skill; they won't work. Again, remember that it is easier for a giraffe to carry a load of umbrella frames through the eye of a needle than it is to invent anything that is really new and useful, anyway.

John Alexander.



Piston Remover.

Beat this Time—According to the Gauge.

Editor The Locomotive Engineer:

In looking over the August number, I notice an account of a fast run for a narrow gauge. now I don't expect you to open up your columns for the competitive liars about fast running, for if you did there would be no end of it, but I want to tell you what a little railroad up in this neck of woods is doing.

I am running on a little two-foot gauge road, the Brighton & Saco River Railroad. We have two locomotives; they weigh but ten tons, and have drivers only thirty inches in diameter. The road is sixteen miles long, has one curve of twenty degrees, and lots of them sixteen to eighteen, and a grade of two hundred feet to the mile. We have made the run over the line, sixteen miles, in twenty-seven minutes, five and a half miles in seven minutes, and three and a half in four minutes.

This is a pretty good sized story—for the wheel—but they can run, and no mistake. Can any of the readers beat us—considering our size?

Brighton, Maine. J. A. M.

[We suppose, of course, that this time was made on the fireman's side of that 200-foot grade—something on the order of a stone falling down a well.]

What is the Difference?

Editor The Locomotive Engineer:

Why is it that, if a back tire on a six-wheeled coupled engine breaks, the side rod should be taken down, while, if a front tire breaks, the rods are left up? as per Mr. Cushing's questions and answers.

I fail to see where there would be any difference. C. H. REYNOLDS.

Cape Girardeau, Mo.

[We fail to see what difference it would make, and have seen eight-wheeled locomotives brought in many times with the back tire broken and side rods up. It is no doubt a safeguard to take down the rod, as, in case the tire comes off, it cannot do the damage it would with the rod on; if by taking down only a *section* of the rod this security can be obtained it is best. To take all side rods down would make the engine unable to handle her train.

Device for Duplicating Irregular Forms on the Engine Lathe.

Editor The Locomotive Engineer:

I see so many valuable labor-saving tools illustrated in your paper that I desire to add another one to the list.

Though not engaged on locomotive work at this time, yet I can see how useful it will be on many things about a locomotive. Many of the lathes now being built have the back taper attachment to them, and a former of any design can be used, but there are many lathes now in use that have not these attachments.

This can be used on any ordinary slide lathe. We use it for turning handles and circular work. A great variety of work can be done by changing the former. The tool holder slides in and out, according to the shape required. It is fastened into the tool-post holder by the piece marked *A*, with two flat head screws.

Think its construction will be plain from the drawings. J. J. BINGLEY.

Watertown, N. Y.

Railroad Shop Management—Good and Bad.

Editor The Locomotive Engineer:

What is good shop management? As "Order is heaven's first law," the first thing is to keep the shop clean and in order, next to keep the machine hands on machines, and see to it that they keep their machines scrupulously clean.

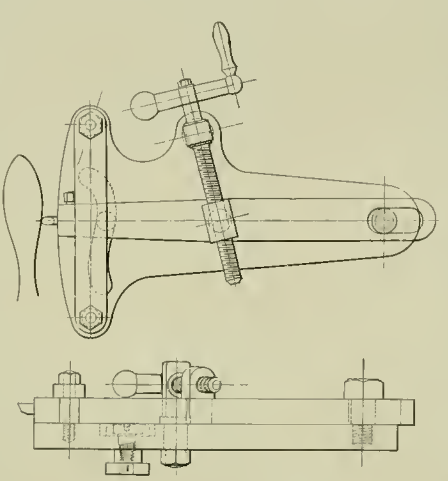
All lathes should have their centers ground in and turned up true to a common gauge, and hardened, so that work can be changed from one machine to another, and have it run true. Throw all square centers into the scrap pile, as they do a lathe more damage than they are worth; have a small drill chuck for your lathe for steel work, use two center punches for wrought iron work; keep all lathe tools well hardened and ground, so they will cut, and not tear off the metal. All lathes and planers should have a water can for wrought-iron work; the writer has used water with good success on mild steel (crank-pins).

Have a hole drilled in all flat or lathe drills, and hang them up, when not in use. Put neatsfoot oil on belts instead of resin; have dirt box and tool shelf on all lathes possible, as described in THE LOCOMOTIVE ENGINEER for September. Keep lathe dogs hanging up where they can be found; put all bolts and clamps belonging to lathes and planers where they can be found when wanted in a hurry. Have all machines painted and varnished, and the numbers of all thread gears painted on them, so there can be no mistake in picking up the wrong wheel; keep a man on drill press, and keep all drills dressed in good shape, and ground to gauge, and allow no alteration in them. Soapsuds or water with washing soda is good for drilling wrought-iron, and is cleaner and cheaper than oil.

Put a drill press and grindstone in boiler shop for use of boiler makers and blacksmiths; put a man in tool room to serve out and repair tools, also put oil tank for use of shop in tool room, and have cans ready filled to exchange for empty ones; discharge the first man that uses a hammer to start a tap—taps that are right will start themselves. Keep a good emery wheel in the shop, and keep it running true; run the grindstone true and fast. Run lathes and drills at a good speed on small work; use coarse feed on planers when possible, and get the work out.

Don't allow vise hands to run the tools, but let each stay where they belong; put self-feeding oil cups on all line shafting and loose pulleys, keep windows clean and let in the daylight—it costs nothing. Have all forgings made close to size; don't have men running about the shop, or to the scrap pile, to find material to work with; have all nuts for finished work tapped to a standard size and thread (not $\frac{1}{64}$ large), and have them on hand when wanted.

Don't allow old clothes, boots and shoes, broken tools and scrap-iron to accumulate on or under the benches; keep the men busy without being overbearing; avoid familiarity with the men under you, treat all with consideration and respect, but hold your own ground. A clean, orderly shop is an advantage to the men, a profit to the employer, and good for all concerned. Shops have been run, and can be again, on the above principles, and the foreman who does it is a live, wide awake man, and up to the times.



DEVICE FOR DUPLICATING IRREGULAR FORMS.

Bad management starts in with a dirty shop, broken drills lathe and planer tools, bolts, nuts and clamps, litter the floor, lathe and planer tools are ground every way but the right way, drills are ground in all shapes and sizes, broken and thrown on the floor; everybody runs the lathes, planers and drills; result, machines in a broken, dirty, filthy condition, nobody cares a continental, so the time is put in. Men go to the tool room, take out tools and throw them down when done, no account taken of anything; break and waste; "the company is rich let them stand it," is the motto, and in a great many cases it serves the company right.

Smith puts a job on the planer, gets a tool ground, lays it down and goes to the roundhouse to work, Brown comes along and throws Smith's work off and puts his on; Jones is on a lathe and is cutting a tap, he is sent to the roundhouse to put in a tender brass or drill a lot of holes with a ratchet; O'Brien throws the tap out of the lathe to turn up a lot of patch bolts, uses Jones' lathe tools, and breaks them, lets the tool catch, and off goes the point of the lathe center; before he gets through he breaks one of the thread gears, and then goes and jumps some other man's vise.

John Doe uses the drill press, the belt breaks, he goes off and leaves it, and the next man comes in a hurry, but must stop and lace the belt.

A boy in the shop wants to be smart, and throws in the back gears while a lathe is running; result, a lot of teeth knocked out, but it is all right, "the company is rich." A lot of follower bolts come in from the blacksmith shop, forged from $1\frac{1}{4}$ iron, to be turned to $\frac{7}{8}$ in., the heads are forged $\frac{5}{8}$ thick to be turned to $\frac{1}{2}$ in.; there is a little taper left on the heads so the follower wrenches will slip off, and as they are not all of a size it will require a number of wrenches to fit them; other forgings, supposed to be bolts, are brought in, they are curiously wrought bolts indeed, but as the heads are neither oblong nor square, and no use can be found for them in or about the engine, they are hove over into the scrap pile.

If it is cold weather, and the oil won't run, set the supply can alongside the stove to thaw out, open the faucet, and go away and forget about it, the stove gets in its work on the oil, if the floor is any criterion to go by.

Brown wants some wedge liners, he goes to the iron rack, takes down a whole sheet, and mangles off what he wants on a pair of old dull shears, throws the rest on the floor, no account kept of it—everything goes—put in all the time you want on a job, and charge it up against some engine.

An engine goes into the back shop for general repairs, fire-box, etc., the ash pan is dropped into the pit, it lies there, a catch-all for bolts, nuts, rivets, boiler scale and what not, and is a delightful thing for men to climb over while the engine is in, and as the pit is a receptacle for waste water, there is lots of joy for the men who do the work; the foreman don't care, *he* don't have to tramp around in it.

The valve on the stationary engine is not right, but so long as it keeps the belts all jerking and whipping about, it will do—"the company is rich."

Machinery is run in an exposed and dangerous condition, the foreman knows it, and he knows the company is liable for damages for injuries to the men; his attention has been called to it, but so long as *he* don't get hurt he don't care. Work turned out of a shop of this description costs over a hundred per cent. too much, and when done is done badly. Show me a shop run this way, and I will show you a foreman that ninety-nine times out of a hundred is a lazy, shiftless nobody, with no record for anything but wire-pulling. W. DE SANNO,

Engineer and Machinist.

Corry, Pa.

Wants to See One.

Editor The Locomotive Engineer.

If you hear of any locomotive engineer or fireman answering "Yes" to Question 1, under head of "Combustion," in Mr. Cushing's questions and answers, please publish his picture. I have no good photograph of a first-class liar in my collection at present. JAMES ARCHIBALD.

St. Louis, Mo.

Not so Sure Now.

Editor The Locomotive Engineer:

Like all engineers who watch their engines carefully I try to locate cause, and have before now thought something was wrong that proved upon investigation to be all right, but I never was quite so badly beat as I am now. I am riding an engine with a 17x24 cylinder, and only a 4-inch dry pipe, and I have been kicking for two years to have that pipe enlarged. The engine does well enough on slow runs, but, come to crowd her, and she seems to choke up with indignation. I swore all the time that it was because she could not get steam through that little pipe fast enough, but the other night I struck a wagon and broke off the hand rail posts on one side; one of the studs in the boiler pulled out, and left a hole less than half an inch in diameter, and, to save my neck, I could not keep that thing from blowing her off, and got less than a mile with my train. Now, if a half inch hole can carry off more steam than the boiler can make, what is the use of steam pipes as big as the cylinders?

Buffalo, N. Y. P. J. DANIAN.

A Guide to Go By.

Editor The Locomotive Engineer.

I think that, when telling young runners and firemen how to set eccentrics, as in Answer 26 U. P. Questions and Answers for the examination of enginemen, that it impresses the student better and makes it easy to remember, that, in setting eccentrics, always move the loose eccentric in the direction it is intended to run when it is in gear. There can be no mistake made then.

Speaking of water grates bursting, Answer 69, I never saw one burst or burn out that did not of its own accord attend to the putting out of the fire.

THOS. SHERIDAN.

Jersey City, N. J.

A Simpler Way.

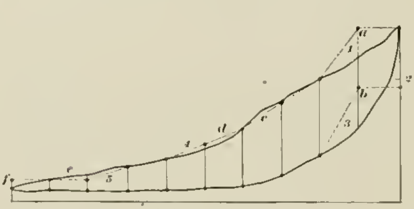
Editor The Locomotive Engineer:

Thinking that the method shown by Fig. 4, October issue LOCOMOTIVE ENGINEER, of laying out indicator cards for measuring ordinates, might not be clear enough to some, I have taken same card, and shown lines more fully, thus giving the complete outline of card as re-arranged.

It will be noticed that the new lines do not alter the length of ordinates shown by Fig. 4, or change the method, but it is hoped that it may be made more clear.

The parts *a* 1 and 2 have been added to take the place of *b* and 3, and *d* and 4 for *c* and 5; the parts *e* and *f* also being equal exchanges.

Harrisburgh, Pa. CYRUS F. RICHMOND.



A SIMPLER WAY

Getting Age Problems on the Road.

Editor The Locomotive Engineer:

All this time that I have been keeping still I have not been dead nor yet asleep—I have been running. I left the Kid about a year ago to try my hand at running, and thought it would be just as well for me to keep still and saw wood for a while as to be telling what I did and some one else did not know. I am soaking myself in experience, and in a year or two more will be able to spit over my shoulder and talk about "us old timers," and refer to the young runners as the "tidbits," the "kids," etc., but every day or so something comes up that shows me that I am not so well posted as I think I am, and I am going to mention a few of them to you.

Here is one: Coming to shop with an old engine from a coal branch; she has pumps, the left one has no lug on the crosshead, no air chamber or hose—I don't see how she got rid of so much at once—but the right-hand pump is all right, that is, it will work. I dropped over a hill, and there is twenty miles of a fall in front of me; I try to shut off that pump for the first time, and find that the lazy cock is in the same position it has always been—is rusted fast and cannot be moved, even with a coal-pick. I try to shut off the tank hose, and find that I cannot do so—it is off the stem and out of the hole. Now I have to get that old tub in, and I found out how I could do it about the time she was too full for utterance, and I did it without getting off my seat. How?

The Kid bet a box of cigars with the roundhouse foreman that he could put a pail of boiler scale dope into his boiler with steam on it, and without putting it into the tank or the feed hose, and without running her a foot. She had one pump and a Little Giant lifting injector. He did it. How?

TEXAS.

Galveston, Tex.

[You could prevent that pump from getting water by putting on the heater wide open, this would blow the water back into the tank.

The "Kid" could put that liquid compound into the boiler by letting the injector drink it. Take out the valve over the overflow nipple, replace the plug, put the injector to work, and you will find a strong suction at the overflow; hold a pail of the "dope" up there, and the instrument will take it up and carry it to the boiler.]

On Examination Questions—A Book Needed.

Editor The Locomotive Engineer:

I have been looking over Mr Cushing's list of questions and answers for engineers and firemen, and on the whole rather like them, not that I think they are *all* right, and can be followed implicitly, but they are the seed of something better—the idea will grow.

I don't believe you can lay down a set of cast-iron laws, that can be followed implicitly; it would be impossible; the circumstances of every case differ.

What is wanted in laying down or in living up to rules in a case of emergency, is to teach the runner to follow his own best judgment in accomplishing a certain number of things that *are* laid down in the rules, with the means and under the circumstances in the case.

First, to protect his train, insure it against being run into.

Second, to clear the line in the shortest possible time, and let trains by, delaying inferior class trains, if needs be, in order to let passenger trains make their time. Here comes in a chance for the engineer to show his judgment, and tell by his acts just what kind of a railroad man he is. Sometimes he will find it the best to disconnect his engine, and get half his train to the nearest side track, and proceeding with rest, or he may find that he is so near to shops or a side track, and another train so near due, that any attempt to disconnect would cause unnecessary delay, it might pay to do nothing until the train came and pushed him into a siding where he could do his disconnecting without disturbing the other trains on the road.

It is considered a disgrace to be towed in; well, it is more of a disgrace in my eyes to hold several important trains while a fix-up is made to run a few miles that might have been almost entirely averted by letting your disabled engine be towed in.

The railroad company earn their money by hauling freight and passengers over the road, every minute is of value, and the reputation of the line depends on the trains making time. Every effort should be made to further these ends.

I know it is a difficult thing to explain, but no one has yet hit the nail on the head, in giving the subject of combustion a practical explanation. Mr. Sinclair did very well in his little book, but it failed to convey the proper information into the heads of average engineers and firemen, and Mr. Cushing's book leaves us in the same fix. Don't you know some one who will be able to tell us something about the subject that we can absorb, not how much beltiric acid gas there is in four miles of air, and how much oxygen it takes to burn it, or burn itself, but what to do under different conditions, not by the name of the gas, but by the appearance of the fire? We want to know something about heat, what it is, and how much of it we can use, and how much we cannot use. I am hunting for a work that will tell me the scientific facts of the case, and then just take me into its confidence and say, "Now, look-a here, old man, it's like this," and then compare the case to something I know about, and can see the comparison. I want that book to pull the fire-door open, and say, "Now do you see that the fire seems to have a shell on it, a little mantle of blue flame; now that is because there is not enough of this blank gas to combine with that blank acid, and you see how I make her hustle by doing so-and-so," then tell me how to do it.

I would like that book to tell me how in the name of old combustion herself I am going to pull fourteen cars three miles through a certain city with soft coal, and obey the city ordinance, not to throw any smoke, or put in coal, or stir the fire, and follow the superintendent's order to run with the door on the latch. I have to keep up over a hundred pounds to pull the train, I have to keep some water in the boiler, but must have it boiled up ahead, as I am prevented from heating it after I start.

When some genius combines theory and practice, enough to get out a work on combustion on these general lines, I want a copy, if it costs me $10.

Albany, N. Y. W. E. ANDROS.

Federation, Almost.

The engineers adopted a plan at their late convention, that admits of the men on any road to federate with other trainmen, if they feel so disposed, to the amount of the necessary two-thirds majority. We were always disposed to be a home-ruler, let each locality take care of itself. We are a little afraid that in case the firemen got into trouble first, the federation scheme would be inactive, but if there was a chance for war on the engineers' side there would be great scrambling to get federated at once. Either federation is right or wrong, and should be so agreed upon. We are inclined to think that it would be a mighty good thing for the engineers and firemen to be under one general head in times when trouble is imminent, but have always thought the amalgamation of all trainmen and enginemen would be a top-heavy organization; but that is not proving that it would.

Bound to Work.

It is a very convenient thing, after inventing a device, to be able to create a demand for it—have the authority to adopt it. Many a railroad device, that is now the "standard" of some system, would have died a bornin', if it hadn't been for the fatherly or motherly relations that some official of the aforesaid system bore to it.

Once in a while an inventor invents something and finds at the eleventh hour that there is no place for it; the long-felt want that it was especially designed to fill does not exist. To be able to make a place for it is a privilege worth something—it saves the invention. The older railroaders of New England will perhaps remember the following circumstance, recently related to the philosopher of this paper by an old-timer from the backest county in the land of hard cider and granite.

"On the old Norwich & Worcester road some twenty or five and twenty years agone, I think it was when Richard Colburn was the master mechanic," relates our informant, "there was a valve invented that was designed to go into a pipe between the cylinder cocks; this valve was made to open at a given low pressure, and remain open until closed by a sudden high pressure. The idea was to prevent back pressure on the pistons; the large valve was supposed to stay open and prevent the compression from doing too much work on the wrong side of the piston, and then automatically close at the moment of admission. Well, the first one was made with great care, and presented an imposing appearance with its O. G. dados, and fluted columns, and it was placed on the old Hinckley, insider, War Eagle, but it seemed to have missed connections altogether, wouldn't work, and after much tinkering and experiment the cause was discovered—there wasn't enough back pressure to close the pesky valve.

"Now you or me would a tho't that we had jest simply slipped up, made a thing to prevent something that wan't there, but they didn't, you bet; no sir, they jest took out the old War Eagle's valves and give 'em more lap on the inside, a plenty too, $\frac{1}{16}$, or $\frac{1}{8}$—there had to be back pressure enough to shet them valves—and every engine on the whole pesky line was fitted up with them, and they had to work—'cause if they didn't have back pressure they was fixed so as they hadn't no trouble to find it. Didn't run long? you bet, they was runnin' that way the last time I was up in them parts, and that is, well, lemme see, long about eighteen years ago, I reckon."

We recently heard an ex-master mechanic say that he railroaded at least four times as long, before he got to be an M. M., as any superintendent did, before promotion, that he had worked with, always had at least four times as much to do, more men to handle, and never got more than half as much pay, and the only way he could see to get a living salary, was to own a patent on the standard stack, ash-pan or valve-gear. The officials of our motive power departments are not paid anywhere near what they are worth or earn. Perhaps if they were they could afford to give some of their standard inventions to the poor.

Accomplished the Objects Sought.

In a private letter to the editor, George W. Cushing, superintendent of M. P. of the U. P. Railroad, says:

"I notice the criticisms of Mr. Mumford and others, who review the questions and answers published in the Engineer.

"The matter was not, as you know, intended for publication, nor was it originally intended to be placed as a whole in the hands of the men. The questions only were so intended to be used. When it was concluded to put the questions and answers together, it was thought best to so frame a few answers as to elicit discussion and criticism. This was particularly the design in the answer referred to by our young friend Mumford. By careful reading of the Answer 57, it will be noticed it does not say that explosion of gas *is cause of failure*. As a matter of fact Mr. Mumford is right, and his criticism was expected on the point referred to.

"The writer has been favored by letters from numbers of engineers and firemen in relation to several points referred to in the little book. To reply would consume more time than is available, but the fact that interest is excited and discussion is going on, is perhaps enough to ask or expect, and I feel gratified at the result."

We were fully aware of Mr. Cushing's intention in leaving some of the answers open to criticism; it was to stir up discussion and argument. The many letters we have received on the subject have shown an interest that we do not believe existed a year ago, and this is encouraging, men are thinking, they are trying to keep up with the procession. Mr. Cushing's book will be the forerunner of other and more elaborate ones, and thus little by little the standard of efficiency is raised.

A Difference.

When the English driver was over here giving the P. R. R. boys pointers on the compound, he told the writer, during a pleasant visit, about some of the differences met with here and there.

"You hengineers are thought more of 'ere than we har," said he, "now hi go up town with some of the lads an' they meets a lawyer, hor a doctor, hor han h'officer, han they says: ''Ow do do, Mr. Jones, 'Ow do do, Mr. Smith,' han-so-hon; now 'hover in the hold country, them fellows don't look at you, they says: 'The driver—'im to 'ell!'"

Elementary Lessons on First Principles.

Third Lesson.

In Fig. 1 will be found the commonest arrangement of hanging links on our locomotives. As the raising of the link slightly affects the position of the pin at top of hanger, forward and back, the best results would be obtained by making the tumbling shaft arm as long, at least, as the eccentric blade, but this is impractical. To prevent the raising and lowering of the link at each end of its stroke, the hanger should be long. In this form the arc a b, through which the lower end of the rocker arm and the link block travels, coincides considerably with the arc c d, through which the hanger carries the link; the difference between these two arcs is provided for by the link sliding up and down on the block, familiarly known as the

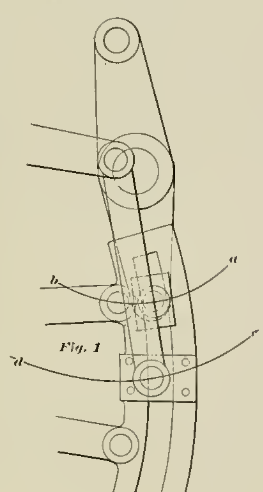
SLIP OF THE BLOCK.

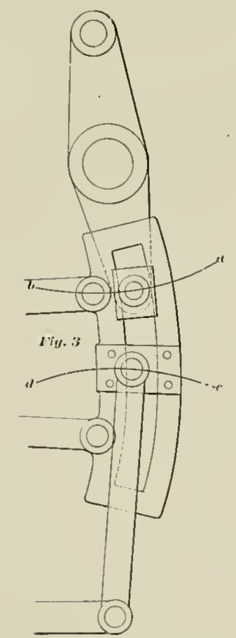
This was a great bugbear to early builders, and many devices were gotten up to avoid it, the best known device of this kind being the one used by Wm. Mason and other builders of his time.

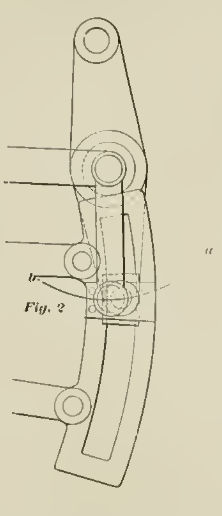
This is shown in Fig. 2. He suspended the link from

ABOVE THE CENTER,

and fixed the length of the hanger so that, when the engine was working in eight or ten inches the upper end of the hanger would stand on a line with the center of the rocker, and the suspension stud on the link would stand on a line with the link block, then the link and the lower end of rocker swing through the same arc, and the slip of the block was reduced to a minimum.







Lessons on First Principles

Of course, when the link is in full gear, or in backing, there is a difference in the slip, but it was reduced the most in the position most used. The object in reducing the slip was to prevent wear of the parts, but it was impossible to *entirely* prevent slip, as the angle of the link would cause some movement, and the consequence was that the links were worn more, all load coming upon a part of the link little larger than the die block, and a shoulder was soon worn.

Again it was found that locomotives with links hung in this manner were not so smart as those of the same style, but having the then common

UNDERHUNG LINK,

as in Fig. 3, and its value was a matter of considerable speculation and dispute among engineers and designers of a decade or two back. Old runners will, we believe, bear us out in the assertion that these engines with underhung links were really smarter than those with overhung links.

The cause is plain when we examine the arcs a b and c d, in Fig. 3. It will be seen that, when the link swings away from the center, carrying the block with it, that the two arcs leave one another, causing excessive slip. This was greater in full throw than when hooked up, as the centre of the link travels a shorter distance back and forth than the ends do. With this motion the valve was delayed at the ends, which kept the exhaust port full open longer, as well as the steam port on the other end. When the link approached its central position it was hurried in the same proportion that it had been delayed in its outward trip, thus giving a quick opening of the valve and closure of the exhaust.

About Russian Railroads

We received a very pleasant call last month from Mr. W. A. Abegg, a gentleman who has spent the past thirty years in Russia, and is now a large dealer in railway supplies at St. Petersburg. Mr. Abegg says that the railroads now being built in Finland are receiving the attention of the imperial government, and are well built and profitable lines. They use 65 pound rails and wooden sleepers. He says there is a good opportunity in that country for the establishment of locomotive works, there being but one in the country, with a capacity of but eight or ten a month. Just now the government stands in need of a large number of locomotives, but the excessively high duty prevents their being built abroad. A good 35 ton engine is worth there about 22,000 rubles, or 11,000 dollars. Iron is plenty and cheap, and coal is worth about three and a half dollars per ton. America can produce locomotives and other machinery at about half the price that Russia can, and Russia can produce any quantity of raw material at about half what America can—there is more crude oil running to waste upon the ground every day in Russia than is produced in these United States—what a nice little dicker it would be, all around, if we could trade—if it wasn't for the fence.

Car Heating.

The harvest time of the car heater men is at hand. There are now over fifty "systems," all having their own peculiar advantages, and—dare we say it?—"disadvantages." Most any of the systems are all right on five or six cars; it is the fifteen and eighteen car trains that make the sweetness—and the heat—long drawn out, and exceedingly chilly. The direct steam heats up quicker, but the hot water holds the heat longer when the engine is detached. And most any of them are cold enough when the engine dies in a snow bank.

Taking everything as it stands now, there is little doubt that the hot-water rig is the best. All will have to make some provision to keep up the heat by fires after the locomotive is cold in death—a sort of an emergency clause.

The greatest problem is to get a universal coupler that all can use, so that the interchange of cars will not kill off the heating arrangements.

LOCOMOTIVE ENGINEER. DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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Standing Notices.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

Our Birthday.

With this issue THE LOCOMOTIVE ENGINEER completes its second year. What it has done we leave to the individual reader to judge for himself, for, after all, it is what good a paper does to individual subscribers that determines its value. Judging from the letters received on the subject, we feel very well pleased with the results so far. The circulation has gone steadily forward from the first, and is now ten thousand copies.

Manufacturing concerns have patronized the advertising columns liberally, and found, as we contended they would from the first, that what was of interest to the men in the ranks was of interest to the officials over them, and that all had a certain amount of influence in the purchase and use of tools and supplies.

We are indebted to many friends for the raising of large clubs, a considerable number of which had more than a hundred names.

The paper may now be said to be fairly on its feet. The avenues of information have been paved and improved, and connections and acquaintances formed that make the road, if not easier, at least surer for the future. We are going to try to make a better paper next year, than we have this, and, with your help, we are sure we can.

Compression—Its Advantages and Disadvantages.

There have always been those who have contended that the ordinary Stephenson link motion, such as applied to locomotives, was a wasteful device, and much inferior to other forms of valve gear; yet it seems to fill the requirements of the service very well, its popularity, it has always been maintained, has been because of its simplicity as a reversing gear.

A writer in the *Railroad Gazette* has recently been pointing out its shortcomings, on account of the high compression at fast speeds, claiming that some form of gear that would reduce the compression would be a great advantage—producing a card of greater area.

The advantages would not be all on one side in this case. In locomotive practice long ports and large clearance spaces are necessary for high speeds, in a valve motion that held the exhaust open until the piston had completed its stroke, the loss in steam necessary to fill the clearance space and port would be great; the cooling of the walls of the cylinder and ports would call for the expenditure of more live steam to re-heat them, and the time it took to fill the clearance space with steam would materially reduce the mean effective pressure.

With a compression great enough to fill the clearance space with a pressure nearly, if not quite, as great as the initial pressure, there is a saving of the amount of steam that it would take to fill the clearance, the time it would take to fill it, and an important saving in heat in the walls of the cylinder and ports.

Locomotives need their large cylinders to start their trains, not to pull them when once under way, and it would, no doubt, result in a saving if smaller cylinders were available to use when once under way, and the link motion does, in effect, make smaller cylinders of the ones we have, by taking back in the shape of compression some of the work put into them. Compression is necessary to smooth running at high speeds; were it not for the pressure that commences to gradually check the momentum of the piston and its attachments, and increases until that momentum is stopped, no locomotive would run cool at high speeds, and broken pins would be a frequent occurrence. The momentum of the piston and other parts depend upon their own weight and the speed at which they are moving, "*increasing directly as the square of the speed;*" therefore, compression should increase, being greatest for the fastest speed. As the link motion is hooked up the port is closed earlier, and compression is increased—just exactly what the condition of things calls for.

Were there no compression an earlier cut-off would be necessary, and an earlier cut-off would be ruinous, on account of the condensation. Careful experiments that are now accepted by the engineering world as correct have proven this, and shown that, with a cut-off of but five per cent. of the stroke, the consumption of water due to cylinder condensation was 42 per cent. of the total water used, and with a cut-off at 50 per cent. of the stroke, or half stroke, the loss by condensation was but 14 per cent.

Sir Daniel Gooch.

There has recently died in England a man who has not only seen a revolution in the railway and telegraph business, but himself contributed largely to the successes obtained by them.

Mr. Gooch was born in 1816, his brother and cousin were the first apprentices of the elder Stephenson, and he knew him intimately, he served his time in an iron works in Wales, and then went into the Vulcan Foundry, Robert Stevenson's new locomotive works, two years later he helped start a locomotive works, but it failed.

At the early age of 21 years he was appointed locomotive superintendent of the Great Western Railroad, the 7-foot gauge, a position he held for twenty-seven years. He here invented the fixed link, since called the Gooch link, this link was hung to the frame, the block and valve rod being moved through the slot by the reversing gear. This device is yet much used in Europe, but comparatively unknown in America. Mr. Gooch was chairman of the Great Eastern Steamship Company, and attempted to lay the Atlantic cable after the first project had failed; his first attempt, with the Great Eastern in 1865, was made under his personal supervision, and 4,000 tons of cable were laid—and lost. The next year he sailed on the same great ship, and on the 27th of July, 1866, sent the following message to Lord Stanley:

"Mr. Gooch has the pleasure to inform Lord Stanley that the Newfoundland shore end of the Atlantic cable was laid to-day, and the most perfect communication established between England and America. God grant it may be a lasting source of benefit to our country."

For this service he was made a baronet.

He next took charge of the almost bankrupt Great Western, as chairman, and raised its stock from 38 cents to par, in twenty-three years he doubled its length, its earnings, and its mileage.

Mr. Gooch was the first chief officer of an English railroad that gave to the employes the right of access to the board of directors, the humblest boy in the service could present his grievance, and tell his story at the head office, before judgment was passed in his case.

Sir Daniel Gooch passed away from earth just as the hammers of the wreckers tore asunder the last timbers of the Great Eastern upon the beach of his native land. Like her, he was a humble but important means to a great end, and like her his history should be known and remembered by those who stand upon the foundations he helped to lay, and enjoy the privileges and advantages he helped to establish.

An Elevated Breakdown.

The daily papers of this city have so persistently croaked on the subject of what is going to happen on the elevated roads, that some of them actually believe that something is going to happen, and they never let a chance slip to magnify every little thing.

One morning last month an engine on the Ninth Avenue line, broke a piston and blew out a head on the high part of the line, near 110th street, and the blood-curdling accounts of the "accident" were dished up in almost all the papers. From actual experience on the road, the writer knows that this accident, under ordinary circumstances, means considerable delay, and took a notion to find out exactly how much delay occurred in this case. The accident happened in the busy rush of the morning down trains, when they are running about two minutes apart, the following are the actual facts:

The engine behind left her own train and shoved the cripple into the center track, this took three minutes, the engine then began to push the train ahead of it, arriving at the next station only five minutes late. As fast as one train stopped behind another, the engine was cut off, and the train ahead pushed until a station where a relay engine is kept was reached; this engine got onto the main line and coupled onto the train, and the one behind cut off and took her place at the head of her own train as quick as it stopped. In this way the trains were kept moving, and the latest one at South Ferry, the end of the line, was eight minutes, and all on their own trains except the cripple. No attempt was made to disconnect the cripple; she was taken to the shop by another engine.

Of course this could not be done on a trunk line road, but it goes to show that the management of the "L" roads have the thing down fine enough to keep their passengers on the move, when other roads would have them waiting.

Running 3,500 trains a day, on 32½ miles of road, for hours at a time only one minute and five seconds apart, stopping every five blocks, averaging fifteen miles per hour, and carrying between five and six hundred thousand passengers daily, is no fool job.

Two Good Men to the Front.

On November 1st J. E. Phelan was appointed superintendent of the Missouri division of the Northern Pacific road, with headquarters at Dickinson, North Dakota.

We are not going to waste any taffy on J. E.—he is getting there first-rate; we dislike to see men trained in the motive power department get switched off upon the transportation siding; but the transportation pays best, and, after all, will be better in the hands of a man that knows all about the details himself.

On leaving Mandan, where they have been for less than a year, Mr. and Mrs. Phelan were tendered a banquet by the railway employes, which goes to show the kindly feeling all around, and will, no doubt, always be a bright spot in the memory of those who participated.

T. W. Macfarlane, who has been general foreman of the Mandan shops under Mr. Phelan, takes his place as master mechanic, a well-deserved promotion. Mr. Macfarlane is a thorough mechanic, a reading, thinking man, and will be heard from, from this out.

The Embargo Raised.

At last the engineers have raised the embargo, and will take in members of the Firemen's Brotherhood without obliging them to withdraw from their order. THE LOCOMOTIVE ENGINEER feels as though all the talk it has made in the past two years had done some good in this field, and as the law was repealed on a reconsideration, and by a bare majority, all the helps were worth something. It was a disgrace to the B. of L. E. as long as it stood on the pages of the by-laws of the order, because it was unjust. The demands of the more progressive delegates must have been yielded with a bad grace, as no sooner was the anti-fireman law repealed, when another was made, obliging new members to take out an insurance policy in the Engineers', this, in itself, is a good thing, and should have been done a long time ago for the benefit of the engineers' insurance, but the obvious object was to make the new men drop the fireman's insurance in order to keep up the other. But when a man, or a body of men, does a good thing or undoes a bad one, it is unfair to question the motives, and we don't. The 26th Annual Convention of the B. of L. E. did themselves proud in repealing a law that did them honor in the breach rather than in the observance, and they are to be complimented therefor.

Monument to A. J. Stevens.

We note in an account in the daily papers of the raising of funds by popular subscription, for a monument to the late A. J. Stevens, who was for years Superintendent of M. P. on the Southern Pacific Railroad, that the statement is made that this will be the first monument ever erected in this way to the memory of a workingman. This is a mistake; in 1887, David Shaw, an engineer on the Denver & Rio Grande, was killed in the discharge of his duty, and a very handsome monument was erected by popular subscription, no small part of which was given by the passengers on the train that was saved by his last act.

The fireman on a train that was taking the delegates of the engineers' convention on an excursion, a couple of years ago, was killed, and the engineers of the country raised a handsome monument over him. No doubt there are a good many other similar instances that are only remembered locally. The monument in California is probably the first one raised in that way to a man occupying the position that A. J. Stevens did, but the cases we have cited show that there have been other workingmen remembered.

ASKED & ANSWERED

(52) Ignoramus, Lawrence, Mass., asks:

What governs the adhesion of a locomotive driving wheel on the rail? A.—The weight that is pressing the wheel upon the rail.

(53) W. T. H., Galion, O., asks:

How many passenger trains does the Manhattan Elevated roads run in 24 hours? A.—About 3,500. During the busy hours night and morning, the trains are but one minute and five seconds apart.

(54) Fireman, Denver, Col., asks:

Is it possible, with the present triple valve used on the Westinghouse air-brake, to set the brake, hold it on, and at the same time re-charge the auxiliary drum? A.—No. What controls the movement of the triple valve? A.—The pressure in the train pipe.

(55) Subscriber, Spokane Falls, Wash. T., writes:

We have trouble with our extension front ends scaling the paint, can you recommend some compound that will stand the heat, and not scale off? A.—Where the fronts burn off at the bottom and not the top, it is evidence that the cinders collected there are getting air and burning, this should be looked into first. Boiled oil and lampblack are the commonest kind of blacking used, put on with a sponge; it is almost too thin to scale. For a prepared paint to stand heat, probably the boiler front and smoke-stack paint made by the Jos. Dixon, Crucible Co., of Jersey City, N. J., is as good as the best.

(56) M. M., Pittsburgh, Pa., asks:

What is saturated steam? A.—Steam generated in free contact with water, where the steam could not be increased in temperature without heating the water, or cooled without cooling the water. If steam is in contact with water, and we know its temperature, we can tell its pressure, or if we know its pressure, we can tell its temperature. If we can evaporate all the steam in a boiler, or isolate a portion of the steam, and then heat it to a higher temperature, its pressure and temperature can be increased without increasing its density or its weight. It is then called superheated steam, and by some authorities, gaseous steam. In superheated steam you can increase its elasticity without evaporating more water; with saturated steam you can not. Steam generated in a locomotive boiler is always saturated steam.

(57) K. & W. R'y Employe, Centerville, Iowa, writes:

A short time ago I heard an argument between the roundhouse foreman and an engineer. The engineer had reported his "piston packing" examined, and, the engine not having metallic packing in her stuffing-boxes, the round house foreman took the cylinder packing out. When the engineer came around he said that he thought his report right and that the piston rod packing should have been looked at. Now the foreman claimed that it should have read "cylinder packing" in the report, and there was quite an argument over it. Now for my benefit, and also for students here and elsewhere, I want you to give us your opinion of this case. A.—Broadly speaking, "piston" should include both head and rod, to distinguish it from either the head or rod. It is customary to use both the terms "piston packing" and "cylinder packing" to designate the packing on the piston head, and, while either may do, we believe that "cylinder packing" is the best, as it would leave no room for doubt or argument.

Obituary—Albert B. Ropes.

A. B. Ropes, Engineer of Tests for Southern Pacific Company, died at Sacramento, Cal., Oct. 8th, 1889, aged 27 years.

His active life was devoted to the advancement of principles advocated by THE LOCOMOTIVE ENGINEER, and a more fitting place for a tribute to his memory cannot be found.

Born in Orange, New Jersey, July 7th, 1862, he advanced in life and education, and entered Stevens Polytechnic Institute, of Hoboken, when in his 17th year. He graduated from Stevens Institute in 1883.

After graduating he came West, and entered the employ of Northern Pacific Railroad Co., in machinery department, directed by G. W. Cushing.

Albert first located at Brainerd, Minn., and was employed in the drawing office under management of H. J. Small, Assistant Superintendent of Machinery.

Seeking practical knowledge at all times, he left the drawing office and donned his overalls for practical service in machine shop soon after arrival at Brainerd.

His pronounced ability was soon recognized by his superiors, and he was not allowed to remain in the shop.

Seeking further practical knowledge, he was given position as locomotive fireman in freight service on Minnesota division, and worked successfully at such duties for six months, when he was returned to the drawing office, when of his own option he would have remained on the road.

Albert Ropes may have been considered a boy by many, but to those who knew him best he displayed the wisdom of a seer and the judgment of a philosopher.

He was remarkably bright in knowledge of mechanical principles, and particularly efficient in mathematics.

His knowledge of natural law and conditions was faithful to truth and correct announcement.

Coming West fresh from the East, and a graduate from an institute, it was natural that he should be the object of critical observation and remark, that often begets prejudice and enmity.

Yet Albert Ropes advanced through this experience, at all times knowing his own business and attending to it strictly, without reason for adverse judgment.

Returning to drawing office from position as fireman, he soon branched out into an active field on the road in conducting indicator and fuel tests, coupled with other duties assigned to him by the management.

Albert Ropes possessed one remarkable trait of character that endeared him to all his associates. Personally he was always seeking practical information, but his generous, broad and kind nature was ever willing to return golden information tenfold for that which he received.

He would take especial pains to inculcate the principles thoroughly known to him into the minds of associates seeking knowledge.

Kind and obliging, and at all times accommodating, he made friends on the line of the Northwestern Pacific who sincerely mourn his loss.

His death removes a bright star from the path of his associates, who gained pleasure and profit in daily life from association with him.

G. W. Cushing and H. J. Small having severed connection with the Northern Pacific, and assumed charge of the motive power department of the Philadelphia & Reading Railroad, Albert Ropes was offered and accepted position of engineer of tests for the Philadelphia & Reading Railroad under Mr. Cushing, and entered this new field of labor in July, 1887.

Several months later, H. J. Small taking charge of machinery department for Southern Pacific Co., Albert Ropes was made engineer of tests for same company, with headquarters at Sacramento, Cal., where he remained in active service until death removed him from earthly care.

A natural organizer, with knowledge of the requirements of this progressive age, and ever active in simplifying scientific facts and formulæ, so that such knowledge could be easily comprehended by the average practical mind, the loss of this bright mind from the mechanical field can best be appreciated and mourned by his immediate associates.

For one I sorrowfully pay tribute to his memory, and feel that I but voice the sentiments of all his associates in doing so. J. E. PHELAN.

A first-class fireman or engineer seldom has to go around defending his ability, his associates and his superior officers generally know about his real value. A gentleman does not have to announce himself as such in every gathering; people know it by what he does and says. A firm resolve, fairly lived up to, to be a man and treat all as you want all to treat you, will generally give a man a standing on a road or in a shop, without any other effort.

Denver & Rio Grande—Pueblo & Salida Shops.

(Editorial Correspondence)

Pueblo was the point originally designed for the general shops of the Rio Grande, and a start was made early in the 80s in the erection of a thirty two stall roundhouse, one of the best ones in the western country; but a city council, who were thoroughly impressed with the idea that railroads are grasping monopolies, and must be sat upon, delayed the work until shops became necessary, and they were built elsewhere. Four stalls of the new roundhouse were partitioned off, an engine and boiler put in, four or five lathes, a couple of drill presses, a shaper, bolt cutter and a few smaller tools set up, and, with these few facilities, eight or ten men have been keeping up the running repairs of upward of 50 locomotives in hard service, and rebuilt six to eight consolidation locomotives per year. The divisions south and west of Pueblo are under Master Mechanic Kelker, and this shop is under general foreman W. H. Hubbard, with Eli Tyler in the roundhouse.

Over the large lathe there is an

INGENIOUS CRANE

of home manufacture. The upright is a piece of 4" gas-pipe set on a step on the floor, back of the head-stock of the lathe; about 3 feet from the floor, there is bolted to the upright, one of the largest sized air-brake cylinders into the bottom of which there are tapped two three-quarter pipes, connected to the main through the medium of a common three-way cock; these pipes have two-foot lengths of hose under the cylinder, to allow of its being turned with the post. Above the cylinder the piston-rod is connected to the second joint of a lazy tongs containing four sections, or squares, the top section of which is pivoted to the arm of the crane, the arms of the tongs are made of iron, about a half-inch by three inches, the arm of the crane being about three-fourths by three or four inches, and six feet long, this arm is forked at the post, and carries a roller that supports it against the post, from the outer end there is a brace running up to the post with a roller behind it, this roller runs over a strip that is riveted to the post, this serves to make the whole device turn together with the post. In using the crane water is admitted to the cylinder by turning a small lever, placed about as high as the lathe-bed, and where it can be easily reached from either side of it. The lazy tongs multiply the lift about four to one of the piston travel; it moves steadily, will stand at any position, and lowers quickly; it is a very efficient device for one made almost entirely of such repairs or extras as are always on hand around every shop.

A WATER MOTOR

This shop is now supplied with air all about the shops and roundhouse, just as the other shops of the system are, but it was a long time after the air was in the other shops before it was introduced here, and in the interim, H. R. Jones, who was then general foreman, and who built the crane, was in need of power to drive the cylinder boring-bar and other tools, and he then built a water motor for this purpose, the base of this little motor is about two feet square, the water-wheel being a disk about ten inches in diameter, with buckets about the size of a penny; this wheel makes about 1,800 turns per minute with a three sixteenth jet of water, backed by a hydrant pressure of 60 pounds, this speed is belted and geared down to that required for the work in hand. Two men can carry the motor, it requires no attention, and has given about six years of service without repairs.

DEEP PITS

One thing that strikes the man used to standard gauge roads is the depth of the pits; they are about twice the depth usually found, which is easily explained by the narrow gauge locomotives, with only a 36-inch wheel, that have to be got under.

During my visit they were putting new flues in the stationary boiler, and the steam for the engine was being supplied by the boiler of a locomotive undergoing repairs. It was rather an unusual sight to see men boring out cylinders, putting up driving boxes, etc., while the boiler was being fired from an elevated staging.

In a place of so much importance, it is wonderful how the management here have kept up their running repairs with such poor facilities as they have here.

THE SALIDA SHOPS.

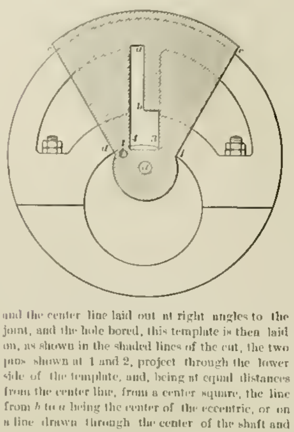
This shop is located 97 miles west of Pueblo, and at the foot of the great range; here the traveler goes north to Leadville and Aspen, and by another route west, over Marshall Pass, to Salt Lake and Ogden. At Salida there is a 16-stalled roundhouse under the care of Ben. De Remer, and a very neat shop under Owen Owen. Giving the size of a shop on the ground, does not in any way convey reliable information as to its capacity. This shop has three stalls, on which, in a pinch, 6 engines might be crowded; they rebuild about 30 locomotives a year. The stalls are in one end of the shop, and stand in the direction of its length. As the shops are new, the tools are new, and all of a pretty fair build. The shop has a disadvantage in standing north and south, the sun pouring in strong enough to make it necessary to put up shades.

The office building, which contains, beside the offices, a large storehouse and the blacksmith shop, stands parallel to the shop, and is nearly as large.

General Foreman Owen has taken great pains to preserve the original measurements of the engines, and has devised numerous jigs and templates to carry out this idea. All shoes and wedges are fitted up to templates, measurements made from the frame, and no liners allowed on new work.

LAYING OUT ECCENTRICS

In making new eccentrics the template shown in the engraving is used to insure uniform work, the pieces are planed at the joint and bolted together,



and the center line laid out at right angles to the joint, and the hole bored, this template is then laid on, as shown in the shaded lines of the cut, the two pins shown at 1 and 2, project through the lower side of the template, and, being at equal distances from the center line, from a center square, the line from *b* to *a* being the center of the eccentric, or on a line drawn through the center of the shaft and the center of the eccentric, then the lower opening at 3 and 4 are guides to scribe the keyway by, and the outsides of the template at *e f* and *c d* becomes guides to scribe the lines to drill the set-screw holes by. This plan secures uniformity of the work and precludes the possibility of mistakes in laying it out. Eccentrics are kept in stock, and it is a great convenience to be able to put on a new one without the usual delays in cutting the key way by hand after finding out where you want it by the cut-and-try plan.

PISTON-ROD REMOVED.

For removing piston-rods from the crosshead, they have a plug of steel just big enough to slip into the bore for the pin; through this, and at right angles to its length, there is a steel screw, about one inch in diameter, and long enough to reach from the end of the piston back of the crosshead far enough to take a wrench; this device is found all-sufficient in removing the most obstinate rod.

ROCKER-BOX JIG.

For boring out rocker-boxes, they have a frame to which the box is bolted in the same position it occupies on the engine, and which has provision to keep the bore of the box at right angles to the frame and in line across it. When this jig is placed on the carriage of a lathe and the boring-bar run through a pair of boxes there is a reasonable surety that their centers are the same distance from the frame in every direction as when they were new.

Great attention is paid to the case-hardening of link motion, and a new furnace for this work has just been erected in the blacksmith shop. This shop has modern closets, and a wash-room, where twenty basins are provided with hot and cold water. The entire plant is kept much cleaner than the average, Master Mechanic Jones taking special pride in a little plat of grass and a fountain in front of the office.

J. A. H.

Union Pacific—Omaha Shops.

(Editorial Correspondence)

With regard to my western trip over the U. P. and the Rio Grande roads, I am in about the same fix as the boy who attended the Centennial Exposition; said he "saw the whole business in two days—but that it would take him six months to remember it."

The Union Pacific is one of the monster roads of the country, and its history is as interesting as a novel.

The Union Pacific Railroad Company was chartered on the 1st of July, 1862, by the Congress of the United States, which granted to it the right of way over the public domain, 12,800 acres of the public lands per mile of road, and a subsidy in Government bonds, at the rate of $16,000, $32,000 and $48,000 per mile of line, the object being to apportion the subsidy in ratio to the cost of the several sections. The amount of the subsidy for 1,033 miles was $27,226,512. By the act of incorporation, the subsidy bonds were to be a first mortgage on the road. By a subsequent act, July 2, 1864, the company was allowed to issue an equal amount of its own bonds, which were to be a first lien on the road, the subsidy bonds being thereafter a second mortgage. For the repayment of the subsidy bonds the company was required to pay annually to the Government 5 per cent. of its net earnings, and to allow the former to retain one-half of the charges for transportation on its account. The time fixed for the opening of the road was July 1, 1876. It was opened May 10, 1869.

The Kansas Pacific also had a similar grant of land and subsidies from the Government. The system is now composed of over twenty distinct lines, containing in all 6,288.40 miles of road, and 414 miles of side tracks.

There are in use upwards of 800 locomotives—143 of which are narrow guage—and more than 16,000 cars.

This road earned in 1888 the neat little sum of $19,898,816.93, and expended $11,779,348 77.

For a system having so many locomotives the road is poorly provided with shops—there are plenty of them, but they are all more or less make-shifts, that have long since become too small for the work, or the work too large for them. All the shops on the line, especially the Union Pacific proper, have built locomotives in the past, that have added to the already complete assortment of locomotives from all American manufacturers, making the stock of repairs to be kept on hand twice what it should be, and making it necessary to make and keep in stock patterns enough to bankrupt a private concern of the same capital. It also produced a lot of fatherless and motherless locomotives, some good, some bad, and many indifferent.

THE WAY TO REBUILD.

George W. Cushing has recently become Supt. of Motive Power here, and has prescribed some heroic treatment that has already had good effect; he has condemned all engines, regardless of present condition, with a cylinder 16 inches or less in diameter. This will at once do away with making up small trains for small engines and reduce the percentage of operating expense—as the same crew, for the same money, will move more tons of freight if provided with engines of modern size. But the greatest gain will be in running repairs, cleaning up with one wipe, tons of castings and forgings now carried in stock, and allow about twenty cords of wood, now treasured as patterns, to be turned to use as kindling. The older and smaller of the condemned engines will be cut up, and those in good condition will be sold or given away. The nicest thing about this change is that

Mr. Cushing gets 47 new locomotives charged, as they should be, to repairs. The new locomotives are mostly consolidations, and are being built at Rome, N. Y.

The Omaha shops are located in the river bottom, were built a good many years ago, are not well arranged or adequate for the needs of the road, and it is not likely that they will ever be enlarged, as they are now building, at Cheyenne, the largest and finest railroad shops in the West; the Omaha shops will then become simply repair shops for a division, with special facilities for repairing cars—a duty they are well fitted for both in size and arrangement.

A FIXTURE.

John Wilson, Asst. Supt. M. P., is one of those men found about all railroad shops, who seem a part of the works, and not an unimportant part either. Mr. Wilson has been on the road some 15 years, and is thoroughly posted on the past, present and future of the shops, the locomotives, and the service. Mr Wilson dropped his work and devoted the day to showing me what they had, and I have no doubt thought me the most inquisitive individual he had met in many a day, that is the general impression I leave, anyway.

From the offices, in a large, two-story brick building, we stepped across a hall into

THE MUSEUM,

named in honor of the relics of every conceivable form that railroad material can get into by being in wrecks, through fires, floods, or long and honorable service. Here are the ends of an axle that has broken in service, here a piece of boiler plate that has broken in the testing department, a brass that has melted itself onto an axle, templates of worn tire, with their mileage noted thereon, pieces of plates and tubes pitted, seamed or burned, scale of all kinds, and a thousand and one things of this nature, all telling some story of experience, and each conveying a lesson. There is here a valve motion model, full size; it is of home build, adjustable every way, the radius of the link being provided for by changing a bar that represents the slot in a link.

Here are stored the painted panels of a car with a history—the car in which the body of Abraham Lincoln was transported from Washington, to lay in State at New York, Albany and other cities of the North, after the closing tragedy of the civil war.

Above the museum is the

DRAFTING-ROOM.

Here all the drawings are made for the road; they are numbered by the sheet, as well as the drawer where they are kept, certain classes of work being kept together; this makes the filing and finding of drawings easy, as all orders and correspondence about drawings refer to the numbers alone; the arrangements for photographing and blue printing are complete.

THE MACHINE SHOP

occupies two stories, part of the lighter tools being up-stairs; the heavy tools are middle-aged, but there are some new ones, a new 24" slotter being especially noticeable. The shop is only fairly well lighted. They lead, or rather babbitt line, truck brasses here, and then place them on a planer, and, at one cut, dress off the face of a whole row of them by using a tool something in the shape of a gouge. After an extended trial they have given up the use of driving boxes with brass bearing strips let into them, and gone back to the half shell bushing. Solid piston heads are used, and both the Richardson and the Morse balanced valves give good satisfaction. They are lengthening out their six-wheeled switchers, making a heavier and more effective engine of them. There was a large passenger locomotive coming out of the shop the day I was there; she had the new extension front, designed by Mr. Cushing, brick arch, steam jets to prevent smoke, and the U. P. standard solid rod. This rod has been in use some ten years, and has given excellent results; it is shown in Figs. 1, 2 and 3, the bushing *a* is forced in from the back, and held by four ⅞th bolts, it is then placed on the pin, which is made in the shape shown in Fig. 3; the retaining collar *b*, which is made in halves, is then placed on the bolts and into the groove in the pin, the cap *c* put in place and the whole bolted together; the bolts hold the bush from turning, keep the rod on the pin, and the whole incased in a sand-proof box. This does away with retaining collars, drilling the pin for keys or bolts, and admits of easy getting down where it is necessary to disconnect on the road; the covering of the collar must also be a good thing in a country where the sand blows, as it does on the plains.

They have on engines with draught pipes a very neat device for raising and lowering the petticoat without opening the front end; to the top of the pipe there is riveted two rods that come up each side of the stack through castings that carry set-screws; the top of the rods terminate in handles, such as used in the cab for the sand lever, by loosening the set-screws the pipe can be raised or lowered at will.

THE BOILER AND BLACKSMITH SHOPS

are much like the other parts of the shop, except that the boiler shop is very small and poorly provided with tools for the large amount of excellent work they turn out, there is, however, a new punch, shear and drill going in there.

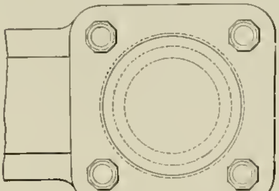


Fig. 1

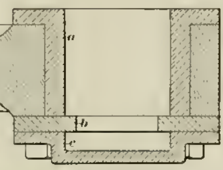


Fig. 2

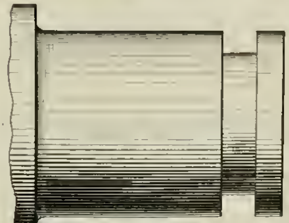


Fig. 3

U. P. Solid Rod.

TESTING DEPARTMENT

This is an important and interesting part of the shops; it is in a building by itself, under the charge of an experienced mechanic, and no doubt is a money saving institution. All material bought has a fixed test to stand before it is accepted. There are several machines to test metals for every service, machines for testing oils, gauge testers and pressure arrangements to test hose, pipe, flues, etc.; some materials are simply to be weighed, some to be measured, but all are tested. There is in this department a sample of all standard supplies, with the test on it—everything has to come up to the standard. Outside the building there are drop tests for car wheels and axles, and such material too heavy to handle in the house. As the purchasing of inferior supplies has always been a cause for complaint, it would seem as though a test department, in the hands of an honest man, was a pretty good investment.

THE CAR SHOPS

are the best and lightest shops in the plant, the machinery of fairly modern construction and in good condition. The shop was half full of fruit cars, or that class of express cars that are run over the road one way in freight, and the other in passenger trains. I believe the experience of all roads is the same in this matter—the repairs to draught gear is simply enormous. The cars have the Miller or the Miller-Cowell coupler to use in passenger service, and they are all right there, as the draw-head does the drawing, and the buffer does the pushing, but coupled into a freight train where the draw-bar does all the work and takes all the grief, they want to see the car repairer every trip. They are equipping a lot of stock cars with an ingenious arrangement, recently patented by Mr. Cushing, for feeding and watering stock, *en route*. The arrangement is not expensive and does not call for radical changes to adapt it to the cars in service.

All cars are being fitted with a new draw-bar stop, also of Mr. Cushing's design, that is much heavier and more effective than any older device, the two sides of the stop are tied together, and double springs take the shocks.

A KINK.

I noticed on an engine out on the road, a device for keeping crossheads on beam, or single bar guides, in line. When the guide is new, they plane a line on its side exactly in the center, this line they true up by a line through the cylinder; then when the crosshead is up and lined with the cylinder, they mark the side at each end fair with the mark on the guide. When the gibs wear, the position of the marks tell where the wear is, and how much, and in lining up it is not necessary to measure between the piston-rod and the guide at all; the scratch on the guide and the marks on the crosshead do not change by wear; the first simply indicates the true line of the cylinder, and the second the distance above the center of the piston-rod that the marks on the crosshead ought to run; this not only allows shop men to line up with more accuracy, but points out at once any blunder made.

TEACHERS

What is going on on this road in the way of educating the men, may be taken as an indication of what is being contemplated on most roads, if not already begun. There are employed here not only traveling engineers, but traveling firemen as well, the duties of the traveling fireman are to instruct new men, and look out for old ones, who are simply throwing coal at a hole, and waiting for their turn for promotion. A few pointers on the prevention of smoke, or correct pointers on correct methods of boiling water are often needed as well on the right as on the left side. Instruction books have been issued, books on the air brakes, on combustion and other kindred subjects, not so much with the idea that the book matter was to be learned like a catechism, but to get them men to think, to argue, and thus to post themselves.

I must say to the readers of the paper that it is never my purpose to give descriptions of shops visited, but to point out such practices, devices and modes of doing work as are different than the usual run, and likely to be instructive, as showing an improvement over, or inferiority to those systems of work with which you are familiar. J. A. H.

Mr. A. J. Allen, a locomotive engineer, lately employed as Inspector of the Nitrate Ry Co., at Iquique, Chili, S. A., has recently come to the United States to introduce a boiler compound invented by him, that has made a remarkable showing in the bad waters of the South American deserts. Mr. Allen has been some fifteen years on the different roads of South America and on the Isthmus of Panama.

The printers of the Engineers' Souvenir of the Denver Convention performed a wonderful feat in showing the pictures of two different men, and designating each as "Governor of Colorado." But the book is a daisy just the same.

The great storm in the Southwest was a grand opportunity for the patent snow plow people to give some illustrations of how their devices work. Every winter the snow king advances his standard a little further South.

Consolidated Shops of the Union Pacific at Denver

The Union Pacific road has acquired, by purchase and otherwise, several lines of road besides its own, that center in Denver—the Denver Pacific, Kansas Pacific, Colorado Central, and the Denver, South Park & Pacific; all of these had shops of their own, so that the consolidated roads have had to maintain shops at all the points of the compass around the city as well as in the middle.

It has now been decided to abandon all the little shops and do the work in one good one; ground has been secured on the site of the old Colorado Iron Works, and the new shops will be commenced at once.

This shop was designed by Geo. W. Cushing, Supt. M. P., and is as convenient an arrangement for an ordinary shop as we can call to mind. The main shop will contain ten stalls, the car shop twelve; the location of the material yards is good, and the plan for getting incoming and outgoing engines around one another is excellent. The ash-pit is arranged to hold cinder cars on a track depressed below the level of the yard, and has a cleaning pit under the tracks each side of it; the supplies of coal, sand and water are convenient to the incoming tracks, while the oil-house is isolated from the other buildings, and is still convenient to the roundhouse, the incoming and the outgoing tracks.

The transfer table tracks are long enough to deliver engines or cars to all the shops, and the scrap heap is limited to one, located in the center, convenient to all the shops. A fifty-foot turn-table will serve the fifty stalls of the immense round-house.

This consolidation of the shops will enable the management of the motive power department to get along with a smaller stock of repairs, and will release to more desirable uses ground now encumbered with poor shops in a very desirable part of the city.

The sizes being given on the plan, the general arrangement can be thoroughly understood from it.

A Careful Engineer.

For quite a distance going into Leadville, Col., the tracks of the D. & R. G., narrow gauge, and the Midland, standard gauge, are side and side, and the boys have a tilt on speed once in a while, the little narrow gauge fellows being surprising climbers on a heavy grade. The boys tell a story on Bill Kreitly, that is not bad; he was running a losing race with a Rio Grande train, and just as they passed him Bill said to the fireman, "Shut your dampers," after they were by the boy was instructed to open them. "What did ye do that for?" asked the smoke shoveler. "To keep from suckin' 'em into the ash-pan," said Bill.

The activity in the steam snow shovel business seems to be all on paper—there are very few actually building.

Simple Lessons in Drawing for the Shop.

By ORVILLE H. REYNOLDS.

SECOND PAPER.

Assuming the drawing-board to be ready, we will discuss the method of handling the instruments which were recommended in a former paper.

Place on the drawing-board a piece of manila paper, 18"x28", and secure it to the board by three drawing-pins at each upper and lower edge, being careful to have it smooth and drawn as tight as possible.

Lay the T square on the board with the head at the left side, placing the left hand on square head with four fingers on the underside, the thumb resting gently but firmly on the blade; in this way the square can be pushed from or drawn toward the operator with ease, leaving the right hand free to handle the pencil, which should be held between the thumb and two first fingers (as in writing) in a nearly vertical position, the top inclining slightly to the right.

There are differences of opinion among draftsmen as to the proper shape of the pencil point, some favoring a chisel point, others preferring a round point, the writer uses the round point for the reason that dimensions can be set off with such a point with greater facility than with the other, although the chisel point will stand fatigue somewhat the best.

Place the pencil lead against the square blade at its junction with the head, and pressing softly to the blade and lightly on the paper, draw the first line the whole length of the paper, keeping the pencil, from start to finish, in as near the same vertical plane as possible, for the reason that, if the top of pencil moves to or from you while drawing the line, the point will also move to or from you in a lesser degree, but still enough to make the line untrue.

After drawing the line, move the T square toward you slightly, and then return it to the position occupied while drawing the line, if the line shows equally plain and is of the same width the whole length, it may be pronounced good; a light line only is permissible.

Draw several lines near and parallel to this, and compare them for truth; this will be a good test, and, if not found satisfactory, can be rubbed out and another trial made. This is why it was remarked above that light lines were the proper thing, for, if the pencil is forced into the paper, the line may come out for the rubber, but the pencil will have left its mark in the form of a crease, more or less deep, which will not come out.

The matter of handling the pencil with a gentle touch is emphasized, because the writer has a faint conception of the difficulties involved above for the beginner, who has done a hard day's work in the shop. Perseverance in this direction will bring happy results, the most important of which is the smooth and artistic appearance of the drawing when completed. Persistent rubbing with the pencil eraser destroys the surface of the paper, and gives the drawing a shabby appearance, no matter how nicely it may be otherwise finished.

To draw vertical lines, or lines perpendicular to those already made, leave the T square in the same position as before, and place the 30°x60° triangle on the paper, bringing the base or short leg against the T square with the 90° side at the left. Now adjust the square truly against the edge of the drawing-board, and slide the left hand along the blade to the right, until the triangle is reached, leaving the thumb on the blade, and applying the fingers to top of triangle, pressing it firmly to the paper, and at the same time making a true contact with the T square blade.

The pencil should be held in all cases as described, and, beginning at the bottom of the triangle, draw towards the top, making a line in all respects like those made horizontally.

Some practice will be required to handle the square and triangle at one time, but this is only another case where practice will make perfect.

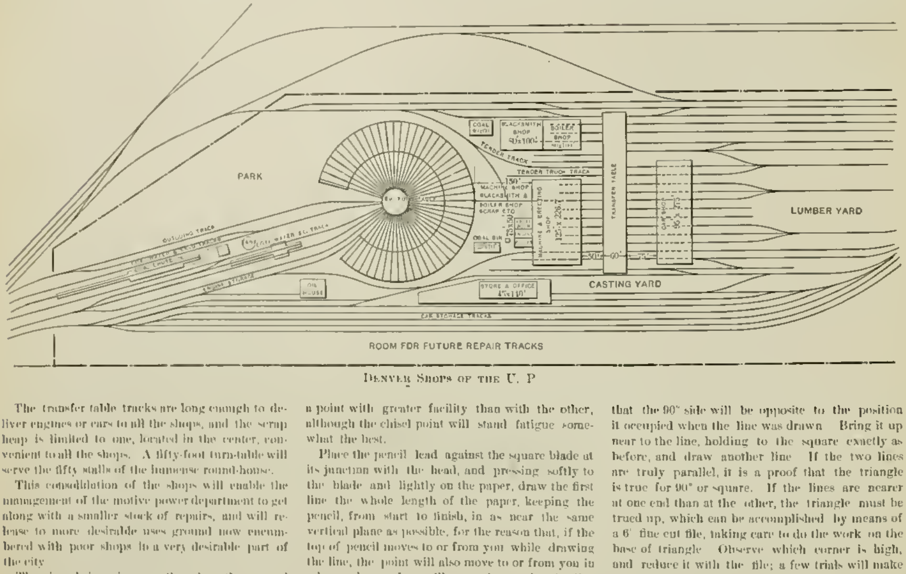
In order to test the perpendicular lines, to know if they are truly perpendicular or "square" with the horizontal lines, move the triangle to a clean place on the paper, and, placing it in position as before, draw a line, and then turn the triangle so that the 90° side will be opposite to the position it occupied when the line was drawn. Bring it up near to the line, holding to the square exactly as before, and draw another line. If the two lines are truly parallel, it is a proof that the triangle is true for 90° or square. If the lines are nearer at one end than at the other, the triangle must be trued up, which can be accomplished by means of a 6" fine cut file, taking care to do the work on the base of triangle. Observe which corner is high, and reduce it with the file; a few trials will make it true.

To test the 30°x60° side, or hypothenuse, make a circle with about an 8" radius, and, with the dividers set to the radius, step off six points on the circle. If the work is carefully done, the dividers go around the circle exactly six times.

Two of these divisions are all that are needed, but, to insure accuracy, step off all the points and draw from two of the points to the center, making an angle of 60°; placing the triangle between the lines so found, its truth, or want of it, is at once shown. If the 60° angle shows correct, no trouble will be experienced with the 30° side; if not right, make it so by the process explained above.

The 90° sides of 45°x90° triangle should be tested by the same method as given for the square sides of the 30°x60° triangle.

To test the 45° side, make a circle of same size as before, and step off eight points; drawing from two of these points to the center, we have a 45° angle. Placing the triangle between the lines, its



DENVER SHOPS OF THE U. P.

truth will also be demonstrated. If found untrue, apply the remedy as before.

The fact that these triangles are bought don't prove that they are true, and, on the principle that they can't be too good for accurate work, see to it that they are all they should be at the outset.

And this is not all; they should be watched, so as to detect any symptoms of change after having been trued up. They are quite human in the respect of going into devious ways when surveillance ceases.

When necessary to draw parallel lines at any angle to the lines drawn by the T square, the triangles will be found to do the work nicely.

Draw first line of required angle, and place the long side of one triangle against the line, then place the second triangle against the first, holding the second rigidly to the paper by the thumb and little finger of the left hand, and the first by the remaining fingers. After drawing a line relax the pressure of the fingers on first triangle, and slide it down the edge of its mate, far enough to make the next line, keeping the edges of the triangles in contact, and being careful not to force them together hard enough to move the second triangle from the position first taken. When angles 30°, 45° or 60° are to be taken, of course the triangles will be used against the T square instead of as above.

As progress is made, the combinations which can be formed with the triangles will readily present themselves to the student.

The dividers, having the pencil leg and needle point adjusted, should be held in a vertical position by the right hand, the thumb and two first fingers taking the instrument at the top, lightly, yet with a grip sure and steady. The legs should be parallel one to the other, from the first joint down, allowing the needle point to gently pierce the paper in a true perpendicular line. If the needle is not square with the paper, the effect is shown by an unsightly hole in the paper for the point to work in, which is an objectionable feature for two reasons: First, the pencil point will not travel in the same path twice. Second, the artistic appearance is injured.

The pencil should be sharpened to a chisel point in this case, because that kind of a point will stand up to its work better than a conical point, when used in a divider.

The pencil should be pressed to the paper just enough to make a clean, fine line, and no more. Once over the path is sufficient if the line is visible and true.

The foregoing remarks apply to the manipulation of the pencils only. The pens will be considered in their proper place.

Humorous and Otherwise.

The young man who is "doing" the European railways for the *Railroad Gazette* is evidently a novice in the railroad business, and a perusal of his notes are almost as good as *Puck*, for a railroader. Those awful printers will make bulls occasionally, but they can hardly be blamed for so many in one issue. He tells of a ride on a German compound, in which all the stock expressions of the young reporter who has just completed his first locomotive ride are used. "The glare of the fire blinds him," in Germany—just like at home. "Rushing along over a strange country without a headlight is exciting"—heard that before. "The steam-gauge is small and registers differences in pressure of about ten pounds—it is graduated in atmospheres"—wonder where the Germans got all that light air? always thought the atmosphere weighed over 14 pounds per square inch. But the most remarkable things are the springs. Listen. "The springs upon which the compound locomotive are mounted are *flexible*, and the engines may be termed easy riding"—wonders will never cease. Listen to him fix out that Dutch stoker.

"The fires burn brightly under the long, slow discharges of steam from the low-pressure cylinder, and there is little smoke *when the furnace is fired properly*. However, in Germany, with all their principles of economy, there exists the same fault that is common in the United States with regard to firing locomotives. There, as in many cases here, the locomotives are run without brick arches, and the coal is shoveled in with as little apparent purpose or mental exercise as would be used if the object was merely to get rid of the coal. Occasionally the fireman stirs up the fire with a long poker, but at other times he devotes his attention to experimenting with the injector, and shoveling coal in a hap-hazard manner into the fire-box and closing the door immediately, thus causing the black smoke to roll in huge volumes from the top of the stack."

That fellow ought to come home; or, if he prefers it, to try a trip at firing there; it is so much different to fire a locomotive theoretically right—with the lip—than to fire them for steam—with a shovel, that he will just simply be surprised.

For the lucid explanation of the English milling machines that are "guided by taper formers," and the driving-wheel that is but "7½ *inches*" outside diameter, we forgive him, and lay it to the printers; but that glare of the fire and those flexible springs are all his.

Perhaps the same young man wrote that description of the New Haven engines in the Nov. 8 issue—they are wonderful machines. The axle journals are 7 inches in diameter and 8 *feet* long—they won't run hot. Slide valves with ⅞ of a *foot* outside lap are hummers, if the rest of the mill is in the proper proportion—may be this is the engine the boys tell about that had a three months lead. The engines are too light on the drivers, in fact lighter than any other engines of their size in the country, but, "In any case, it is evident that the steam used in such cylinders as these, with so little weight upon the drivers, will be well expanded, and if there is any advantage in using greater expansion in locomotive engines without compounding, than that which is commonly used, such advantage ought to become evident from the results of actual service with these locomotives."

What is the matter with taking the drivers out from under the engine altogether, and expanding the steam right down from a hundred and enough to Revelations? We anxiously await a reasonable explanation of how the above law was arrived at.

Speech of General Manager Meeks to the Engineers.

The following speech, by General Manager C. F. Meeks, of the D. T. & G. Railway, to the engineers at the opening of the Twenty-sixth Annual Convention in Denver, contains much that is good and worthy of the attention of every railroad man:

The subject with which I wish briefly to engage your attention relates to conditions, present and prospective in part of railroad transportation, and the importance of the locomotive engineer as a factor in fixing certain standards which must govern in the practical groundwork. We have to-day in the United States about 155,000 miles of railroad which has been built rapidly, and which has in a few years distributed the growing population, so that the country has been settled throughout with an industrious and thriving people, bent upon outdoing their neighbors, and each community ambitious to become a business and jobbing center. Roads have been built in all directions; some of them by the longest possible route between two given points; often with more zeal than foresight, several too many have been built between the same points, all competing for every pound of freight that offers for shipment. The line having the longer distance cannot compete with the short line in quickness of time and service, so that other methods of controlling the business by the long line are resorted to, which the short and direct road resents. Rate wars and competition follow, which can only result disastrously to both. The effect of this strife often involves the rail system of a large section of the country. Associations are formed for the purpose of settling these difficulties by mutual agreement instead of by rate wars, but these associations are founded upon the principle of good faith, and the faith is so often broken that the entire structures are kept in a weak and tottering condition, and answer but partially the purpose of conservative action, the tendency of the times is to reduce the compensation of public carriers to the lowest possible point, without regard to consequences. Congress and State legislatures have been taking a hand until a condition of almost endless complication and increasing hardship has befallen these enterprises. The trouble is organic, and can only be relieved by the work of time and intelligent comprehension of the situation by the people; meantime, the roads are put to the necessity of most rigid economy.

The expense of operating railroads and meeting their obligations must come within the bounds of their income, else the most skillful manager cannot keep clear the shoals of bankruptcy. The locomotive engineer must bear his part of the burden. He must establish the highest standard of efficiency at the lowest expense; he must haul more tonnage with less fuel and other supplies; and he must, by careful work, reduce the destruction of life and property to the lowest minimum.

The time has come when, under existing conditions, it is necessary for every man in the employ of railroads to give his cordial and intelligent support to the work of maintaining a safe degree of service. If the thousands of men now engaged in the operation of railroads would save to themselves the high rate of compensation, as compared with that received by men in other pursuits, they must justify it by the results of their work. A large share of this falls upon the locomotive engineer, and it needs no word from me to suggest to engineers the wisdom of joining hands with the owners and managers of railroad property, for the conservation of their mutual interests and the continuance of the present status of compensation.

Your brotherhood, embracing as it does a large majority of the locomotive engineers of the United States and Canada, is charged henceforth with a grave responsibility. Aside from the benefits and the good fellowship of the organization, there must be a united and systematic effort to establish the highest standard of mechanical skill. The engineer of the future must be not only a man of iron nerve, but a man of the highest intelligence, good judgment, and good faith, and I believe that this brotherhood can do more than all else in aiding locomotive engineers to reach the acme of efficient and economic service.

This is the great work before you, and I hope this convention will inaugurate a systematic co-operation with owners and managers of railroad property to the end that, in the face of all adversities, the locomotive engineer may still continue, as he should, to lead the mechanical world in the rate of his compensation.

You are called upon to share your part in the work of a great people adjusting themselves to rapidly changing conditions, created by unprecedented progress, for which the institutions, of which you gentlemen form a most important part, are in the main responsible. It has all been done in a few brief years, and the people have not yet had time to get down to a solid working basis.

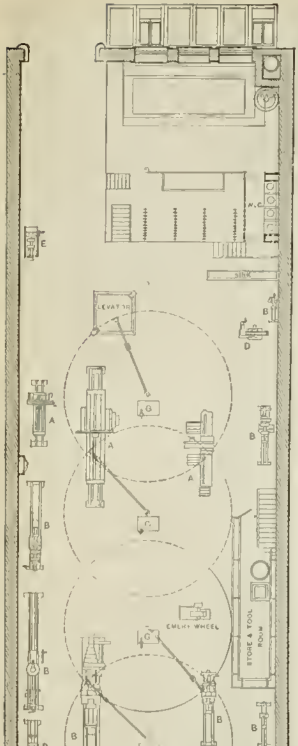
All the ages of man had achieved nothing compared to what has been wrought in the fifty four years since George Stephenson built the little road from Stockton to Darlington. In this brief time the child of that great man's brain has conquered and civilized worlds, has extinguished the savage and reclaimed the desert, has wedded the seas and given to the people of the nineteenth century the distinction of having been the first to discover the true motor of civilization, and the first to enjoy the real luxuries of prosperous lives.

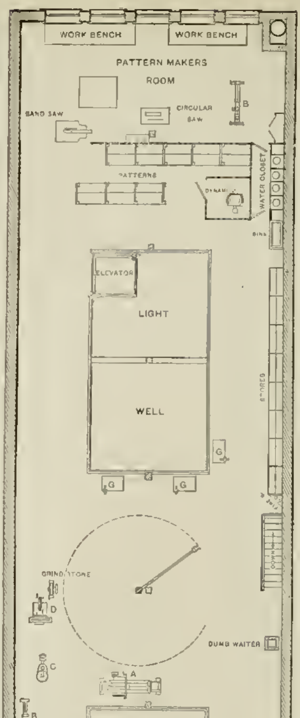
While we are striving to adjust ourselves to those conditions of prosperity, and congratulating ourselves that, in a span of fifty years, we have outstripped all the past, let us not forget to honor the name of George Stephenson, whose spirit sits on the right hand of every locomotive that runs.

Now, I want to say a few words in regard to your brotherhood, and the men who compose its membership. I regard your organization as one of the broadest, the strongest and best with which this, or any country, is honored. You have been conservative, discreet and far sighted, and have achieved splendid results for your individual membership. I have a very great affection for the engineer, and a great admiration for his courage, his nerve, and the good judgment he must exercise to brave the dangers of the rail. Soldiers facing the enemy's guns on the field of battle do not show half the courage the engineer is called upon to have in the discharge of his duty.

And what of your great chieftain? No word from me can add a tithe to his honor. His genius, his qualities of mind, his great abilities, entitle him to a place among the great statesmen of his time. For fifteen years he has led your brotherhood, and led you safely through every difficulty. No general ever led an army to victory with more valor, more courage, more discretion, than your great chief has led you to victory after victory in the long time which he has served you, and with such broad policy that your individual and collective interests have been conserved at the same time as those of the men who have built and controlled these great institutions, and when the history of this, the greatest era of prosperity known to the world, is written, his name will have an important place in its pages. [Great cheering.]

The Strong engine has started on a trip west, and is now in Ohio. She has recently been overhauled, and some alterations made at the Elizabethport shops of the C. R. of N. J. The engine has been for some months on the Erie and the Central, burning hard coal, it is claimed that as she was designed to burn soft coal, and will do better in the West on that account; probably she will, though it would seem as though a fire-box having fifty-four feet of grate ought to burn anthracite coal all right.





A Planers. B Lathes C.—Boring Mills. D—Universal Milling Machines E.—Screw-Cutting Machines G.—Vise

A Model Manufacturing Shop.

We illustrate on this page the general plan of the only shop in the world devoted exclusively to the building of tools for locomotive repairs—that of Pedrick & Ayer, Philadelphia, Pa.

The first floor plan shows the Hamilton street end to the right, Buttonwood street is on the left; the building is 40x160. On the Hamilton street side is the main entrance, with a stair leading to the office; the lower floor is entirely occupied by machinery, the location being plainly shown in the plan so plain it needs no explanation. On five of the supporting columns are hung cranes that serve all the machines and cover pretty much all the floor space. The Buttonwood end of the shop has a large entrance for teams, and a load of castings can be loaded or unloaded on the elevator, without lifting them up or lowering, as the elevator can be set to the right height. The square space shown in the lower left corner, and near the door, is a raised floor on which the tool dresser's forge is located, and the stock of iron and steel kept; this floor is about as high as a wagon, which makes it handy about handling heavy stock. The nicest part of the plant is not shown, and is the part located under this raised platform—the engine-room, boiler-room and casting store-room—the coal-pits are located under the sidewalk. The shop is heated by an improved exhaust system and lighted by electricity. Wash-sinks and closets are located on both floors.

In the front of the second story are the offices and drawing-room, as shown in the excellent engraving. The large light wells through this floor lessen the floor room, but all over the shop the light is excellent. On this floor are some of the lighter tools, and many of the benches used by those erecting machines, much of this work being done here. One crane covers a large floor space on the erecting floor. In the back is the pattern-room, fitted with the usual woodworking tools used by pattern makers. On this floor is the dynamo-room; this is kept locked to prevent accidents. There is an incandescent light over every tool, at every vise, and everywhere there is need of the least ray of light. The office and drawing room are finished in natural wood, and are as neat as can be found anywhere. There seems to be material and tools on hand to do anything that needs doing in the best manner possible; there is no excuse for poor work, and, no doubt, the special tools turned out by this firm in the future will excel the already excellent work they have long been noted for.

The 24-O'Clock System.

J. A. Kammerer, president of the Railway Station Agents' Association, and a train dispatcher on the Canadian Pacific, prepared an interesting paper on the above subject, to be read before the association at Kansas City. It has just appeared in the *Northwestern Railroader*, from which we make the following selections:

". . . On the Western Division of the Canadian Pacific system, for a distance of nearly 3,000 miles, the 24-o'clock time has been in use since May, 1886, covering an experience with me of one year as agent and two years as train dispatcher. Shortly before the change from the old to the new system, all employes were furnished by the management with paper dials for clocks and watches, on which appeared the figures from 13 to 24, these were of such a size as to fit the dial plate within the Roman numerals from I to XII., and were arranged with a hole to fit the post carrying the hands. These paper dials were coated with gum, and, to apply them, it was only necessary to wet them evenly, and when the hands of the time-piece came together slip the hands through the hole left for the hand-post, get the figure 24 straight beneath the numeral XII., and press it evenly onto the dial plate; this brought the figure 13 under numeral I, and others in rotation to 24.

"This arrangement was so simple and effective that, when the new time went into effect, all employes were perfectly familiar with it, and I have yet to hear of an instance where the new time was not rightly understood or interpreted . . .

"Of course, the paper dials were not so ornamental as useful, and watchmakers set themselves the task of arraying dials in conformity with the new time. We have now the 24-o'clock time-piece, which has the figures from one to 24 on the outer edge of the dial, similar to the old numeral dials. The minute hand moves with the same speed as before the change, but the hour hand travels just one-half slower, thus, at 12 o'clock the hour hand is in the same position it would be at 6 A. M. in the old time-pieces.

"We have also the 'jumping dial' furnished by the railway company. This is a two-dial arrangement—an inner and an outer one—the outer dial is stationary and has no figures on it, but has twelve holes in it at the exact spot where the numerals should be in an old-style dial, the inner dial has the figures 1 to 12, and immediately to the right appear the figures 13 to 24. At one o'clock in the morning the figures 1 to 12 appear in the apertures of the stationary dial. At precisely 12.59 a small spring on the movable dial is released, and the figures 13 to 24 'jump' into view. At 24.59 the spring again causes the movable dial to 'jump,' bringing the figures from 1 to 12 in view. This dial is in use at all division terminals and the most important stations, and gives good satisfaction.

"I do not think that it is the best, but that, as the system comes into general use, something more simple and effective will be invented.

"On a long line like the Canadian Pacific Railway, which has its own time card from Halifax on the Atlantic to Vancouver on the Pacific, a real trans-continental railway under one management, an agent must answer questions of travel covering a continuous ride from one to eight days in passenger service, and from one to twenty days with freight. In running passenger trains from one division over six, eight or ten others, with the old A. M. and P. M. time, we were very apt to miss an A. M. or P. M. on the card, and the printer as apt to make a misprint or omission. As a result we would, in most cases, be from 12 to 24 hours out of the way in our figures. . . .

"In train dispatching, the practicability of the system at once presents itself to an experienced man. Of course there are dispatchers who are old fogies and do not move with the times, who still claim the A. M. and P. M. system to be the best, but the introduction and use of the new system, and the benefits derived from it, will soon make the crankiest of them acknowledge its usefulness, and cause them to wonder why they had not thought of it before."

Some Grievances in Australia.

In New South Wales, Australia, the two thousand miles of road belong to the government and are under the charge of a commission. We have been reading in the *Railway and Tramway Review*, of Sydney, the official organ of the Amalgamated Society of Railway employes, an account of a visit of a committee of the men to present grievances to the commissioners. Some of the grievances were small, but the commissioners seemed to argue against lots of them, just like American superintendents.

Under the head of "What's Being Said," the same paper gives some interesting items as follows:

That it is very hard that up-country employes' washing parcels, etc., cannot reach their destination without half their contents being abstracted on the road.

That a certain Northern Station Master appears to be paid to "booze" rather than work.

That it is nice for him to be able to smoke and chat all day as well, while his clerk does both their duties.

That he might also be a little more civil to some of the traveling public.

That men are now sometimes fined without ever being charged with any offense or being asked for any explanation.

That surely this is not "fair play."

That an officer who smokes cigars all day on the tramway premises threatens to suspend any man whom he sees with a pipe, even if he is off duty at the time. Rough, this!

That a Southern Station Master was lately seen crawling around a sick shunter's [switchman] house at night to try and catch him.

That men who take tickets for socials or banquets should be manly enough to pay for them.

That the Passenger Guards have petitioned for frock coats.

That certainly some improvement should be made in their uniforms.

That B van 8 wants serving the same as No. 4, by reversing the hinges of the doors.

That the Signalmen ought to have had the new kind of uniform—blue with white mountings.

That a small clique of officers protested against it. Such miserable jealousy is simply contemptible.

That one Platform Inspector has resigned and gone back on his train.

That there must be a screw loose somewhere when men throw promotion over like this.

That there are two Station Masters on from 7 A. M. till 12 midnight, and from the latter hour until 7 A. M. a porter is left in charge of Redfern station.

That this is rather a curious arrangement.

That a certain public servant, lately detected traveling without a ticket, has hushed the affair up, although he was served with a police court summons.

That departmental correspondence travels at an enormous speed.

That a simple application to the manager goes through three offices, and a man may possibly get an answer in three or four weeks' time.

That the busy season is approaching. This means long hours for Drivers and Guards.

That the work can increase but the staff must not.

That the Audit Department is still working hard to gain that premium.

That the Guards' overcoats are a very poor sample. Also, why are not the Foremen, who have to be out in all weathers, similarly supplied?

That if brake van 9 had the iron steps taken off and a continuous footboard put on, it might be the means of saving some unfortunate Guard's life.

That when two sleeping cars are put on the train at Albury two conductors are sent with them; but when two are put on in Sydney, only one conductor is sent.

In Ye Olden Time.

When the "Best Friend," which was the first locomotive used in the South and the first built in this country, was put on the track of the South Carolina Railroad its performances excited great curiosity. For a time its driver did quite a profitable business carrying the curious in small parties a few miles out on the line from Charleston and return, for a consideration.

An old schedule and freight tariff of the South Carolina road, now in the possession of an officer of that company, provided among other things that no dogs should be admitted to cars without the consent of the passengers; that conductors must require all guns or pistols in the possession of passengers to be discharged before the persons carrying them should enter the cars, and that no package should be entered on the conductor's freight list for less than 6¼ cents.

After the explosion of the boiler of the "Best Friend," through the stupidity of its negro fireman, who held the valve down a little too long, to avoid the annoyance of escaping steam, a special platform car was placed between the engine and the first car of the train, and loaded with bales of cotton as a means of protecting the passengers.

In the early days of the South Carolina Railroad, before the telegraph came to be the handmaid of the railway, and when hours of delay in the arrival of trains were of less importance than are minutes now, the good people of Charleston were notified of the approach of a train by a flag displayed from the steeple of the railway station. It was the duty of an employe to keep a lookout from this steeple, and hoist the flag when he should catch the first glimpse of the smoke and steam of the locomotive.—*Railway Age.*

A piece of concave sheet metal, half an inch wide, and as long as the water glass, held behind it, with strips around the glass at the ends, is made good use of to see the water. Paint the side next the glass white, and then paint up the center of the strip a bright red stripe an eighth of an inch wide; this strip scarcely shows through the steam, but it makes all the water in the glass appear as red as blood. It costs nothing and makes the water-level plain and sure in the uncertain light. Try it, you will be surprised.

On some of the big hogs on the D. & R. G. the engineer's brake valve has been taken from behind the engineer and placed on the side of the cab ahead of him or on the boiler, but in front instead of behind. The position a man must get into to handle the air-brake is positively horrible, on some of the engines built now. A man takes chances enough of getting bunged up in the regular list of mishaps on the road, without driving his left shoulder blade through the off lobe of his liver in trying to reach the brake.

It is funny how men will kick against an imposition after it has once been pointed out to them. Since the quiet "roast" we gave the ball ticket and souvenir racket in the July number, we have received letters from several manufacturers, and our advertisers, thanking the paper for the article, and often enclosing circulars of people who want such advertising. Boys, it don't pay—don't do it.

A fireman on an Ohio road asks us to say, without giving him away, that it is not necessary to strike a torpedo signal cap with a coal pick to see if it will go off; in some recent experiments made by him, he found that not only would the torpedo go off, but in his case a part of one thumb went with it.

In deep fire-boxes, where deep fires are carried, it is almost necessary to admit air over the fire to complete combustion; where the fire-box is shallow, and a shallow fire is carried, it is not necessary, as the fire can be carried thin enough to let enough air through the grate and the fire, which is the better way.

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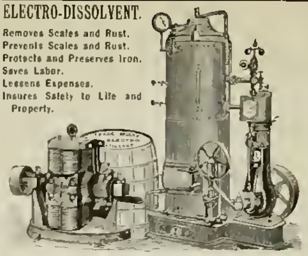

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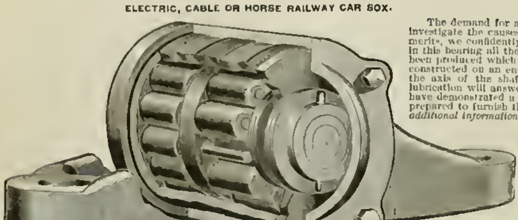

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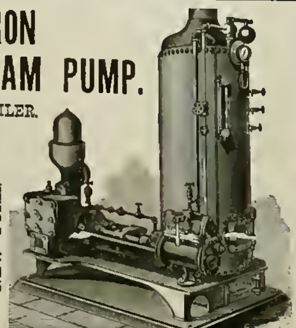

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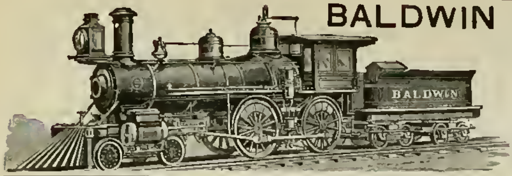

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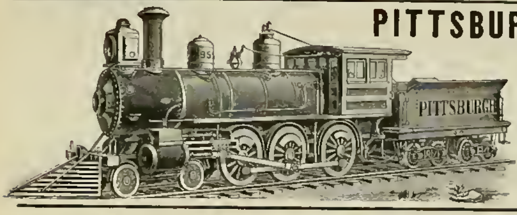

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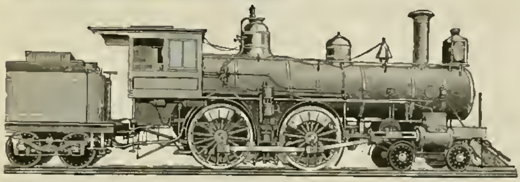

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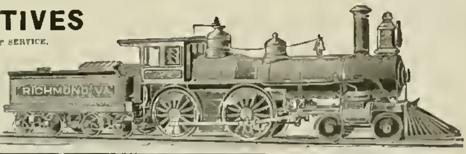

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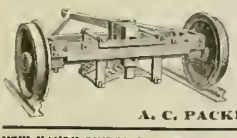

Allows engine to go *around curves* of much *shorter radius* than is possible with *any other* arrangement. Has no springs over boxes or heavy cradles. Can be used under any engine without distorting the frame.

THE SIMPLEST, CHEAPEST AND STRONGEST TRUCK MADE WITH A SINGLE PAIR OF WHEELS.

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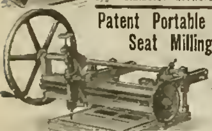
Patent Portable Steam Chest Seat Milling Machine.



For milling out corroded steam chest joint surfaces for strips; facing off whole surfaces and milling out ports. Easily attached. Works rapidly. Designed especially for Locomotives.

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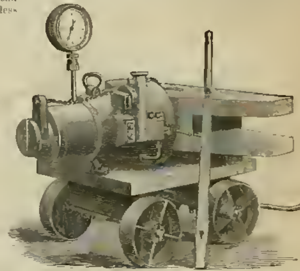
IN USE ON 10 RAILROADS.

Hydraulic Press for forcing pins into Locomotive Drivers, either under the engine or out. Also useful about Railroad Shops, for forcing on and off Balance Wheels, Cranks, Gears, Pulleys, etc. Inclosed Piston Cannot Clog. Valves are large and fall to their seats, no rush of water being required to seat them. Parts easily examined or repaired. Pump is independent of cylinder casting. Movement of ram, 12 inches. 60 to 150 tons pressure.



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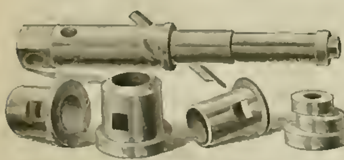

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For removing Flues from Locomotive and Stationary Boilers. One man can cut five hundred (one end) in a day. In use in the leading Railroad Shops of the country. Combination Cutter for removing 2", 2¼", 2½" and 3 inch Flues, $50. Sent on approval to Railroad Co.'s. Liberal Discounts to the Trade.

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BOILER PLATE PLANER.

WILL PLANE ANY LENGTH OF PLATE.

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

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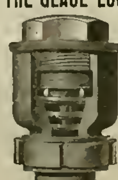

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POPULAR WITH ENGINEERS *Wherever Tried.*

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MANUFACTURERS
Locomotive Pop Safety Valves, Guide and Rod Oil Cups, Railway Brass Goods, etc.
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The Locomotive Engineer.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

1890.

INDEX TO VOLUME III.

For the Year 1890. | Illustrated Articles are Marked with an Asterisk, thus * | 96 Fulton St., New York City

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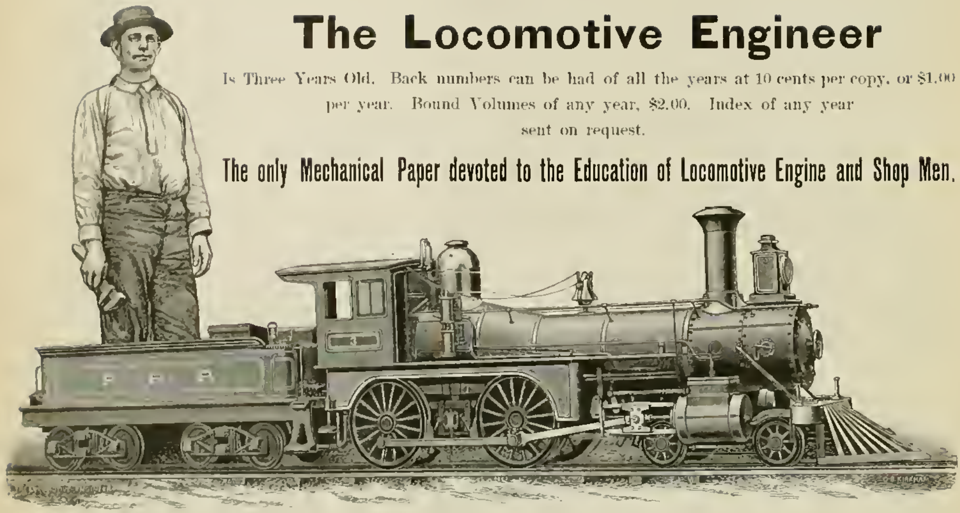


THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 1. NEW YORK, JANUARY, 1890. 1.00 per Year or 10c. a copy.

Punishment by Proxy.

"Years and years ago," remarked the old timer, as he put his feet on our desk and borrowed a light for his briar-root pipe, "years and years ago, when William B. Gage was master mechanic of the old Rensselaer & Saratoga, we had a runner there of the name of Noer Prince, who, aside from bein' one of the best-hearted fellers you ever sot eyes on, was the carlessest runner you ever see; if there was anything to get into or off on, that hadn't ort to be got off on or into, jest rest yer mind it was Noer.

"Onc't up around Rutland some'r's he was lookin' at somethin' else and run off a switch in shiftin', and ditched his engine and half a dozen cars, and Gage went up with the wrecking train more for a good chance to dam Noer off than for the little help he'd be. In them days Gage had a dog, the orneriest lookin', bleary-eyed, stumpy-tailed pup you ever sot eyes on. Nobody but Gage would have give him his dinner for him, but he was always at the old man's heels, never so happy as when he could wag his stumpy tail in answer to Gage's call for 'Jack.' Jack follered the old man up to the wreck; there was a crowd around, among them Noer—smilin' and happy, and trying to drive out a bolt in the main rod and look for Gage at the same time. Gage stepped up on the side of the boiler, getting madder and madder every minit; Jack stepped up too.

"'Jack!' demanded Gage, 'do ye see that switch?' Jack whined and wagged his stumpy rudder.

"'Jack, susposen' you was a running of this ingin'—an' you could do it better'n them as has run her—and you come along here, shiftin', and see a switch wrong, what would you do, Jack? Would you act as if you had any sense at all and reverse your ingin' and open your sand lever? or would you go goppin' around like a dumb-headed ijit and run off the switch, and tip over your ingin'? You'd know more'n that, wouldn't ye, Jack? If you didn't, do you know what I'd do, Jack?' and the old man glared at the dog fiercely as he walked up to him, 'Damme if I wouldn't kick the fool liver right out of ye!' and that old sinner kicked the poor dog far out into the crowd of spectators and marched back to the station, cussin' at every step.

"After that, if any of us boys wanted a drink, all we had ter say around where Noer was, would be, 'Jack, what would you do?' Noer allus answered by walkin' up to the bar and reachin' for his shinplasters."

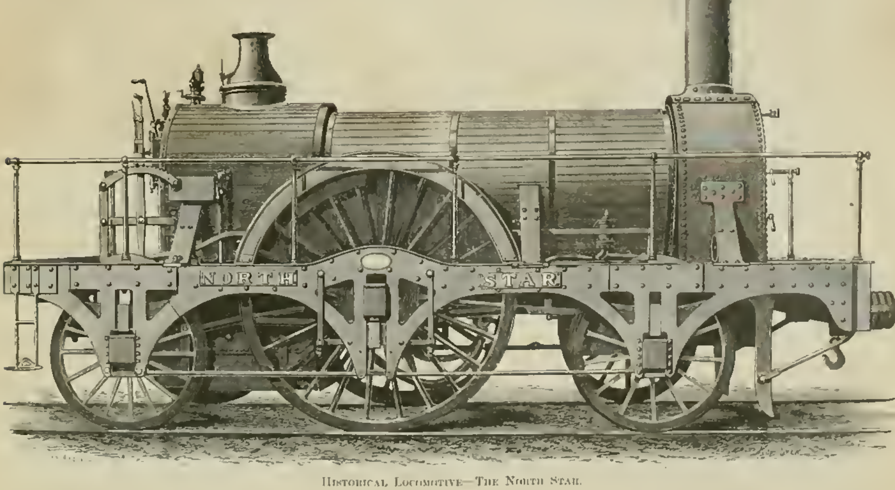
Mr L. W. Rogers, lately editor of the *Railroad Patriot*, has become editor of the *Brakeman's Journal*, in place of Ed. F. O'Shea, who has retired, to enter private business. Mr. Rogers is a man of ability, and a fit successor for O'Shea.

Historical Locomotives—An Early Gooch Engine.

On this page we reproduce from *The Engineer* (London, Eng.) a picture of the "North Star," a locomotive built in 1837 to the designs of the late Sir Daniel Gooch, and one that was long in service on the great broad gauge line. This locomotive was not so far different from the present English practice as were American locomotives of that time different from our present power. This locomotive was built at the works of Messrs Robert Stephenson & Co.; was one of the first used by the Great Western road; commenced work January, 1838, and ran continuously till December, 1870, having been in service thirty two years, making a mileage of 429,000 miles. The engine is now carefully preserved at Swindon, the headquarters of the company

The driving-wheels of this engine were of wrought iron, with round, tapering spokes, being 2¼" in diameter at the hub, and 1⅞" at the rim, and set "staggering" on the hub

The engraving is so plain that all points of interest are easily seen and made plain. The principal dimensions were as follows.



HISTORICAL LOCOMOTIVE—THE NORTH STAR.

Driving-wheel, diameter..	7 ft.
Leading and trailing wheel, diameter	4 ft
Cylinder, diameter	18 in.
" stroke	18 in.
Boiler—length of barrel....	9 ft. 5 in.
Diameter....	3 ft. 11 in.
Number of tubes	167
Length	9 ft 10⅝ in.
Diameter (outside	1⅝ in.
Copper fire-box, length	8 ft. 5¼ in.
Width	3 ft. 10⅞ in.
Height....	4 ft 4½ in.
Heating surface—fire-box. .	94 sq ft.
Tubes	756 sq. ft.
Total.	850 sq. ft.
Fire grate, area... .	11.70 sq. ft.

Simple Lesson in Drawing for the Shop.

By Orville H. Reynolds

THIRD PAPER.

If it were possible to make a drawing with all its lines ending at the proper place at the first trial, there would be no necessity for using the pencil, for in that case the pens would be called into use to the exclusion of the pencil, therefore, being obliged to use the pencil in construction, all lines should pass beyond actual ending place, making a distinct point for the drawing pen to stop at. The function of the pencil, then, is to make a path for the pen to follow, and it is essential that the construction is accurate before any attempt is made to use the pen.

With all reasonable care the student will find erasing to do, but as little of it as possible should be done.

To sharpen the pencils, use a fine file after taking off enough of the wood with the knife, making a conical point for the drawing pencil, and a chisel point for the divider leg.

The drawing pens are handled similarly to the pencils, with the exception that care must be taken not to crowd the ruling pen too hard against the T-square or triangles; any excessive pressure there will tend to close the pen points and obstruct the flow of ink, so that if a line of correct width is started it is likely to be too thin or narrow at the ending, or while satisfactory at certain points, may be so untrue at others as to seriously hurt the looks of the drawing. Aldermanic proportions in the one case, and a consumptive appearance in the other, are the results.

Drawing pens after use show wear on the points, the amount of which depending on their use and hardness, one or both points having a flat spot, which also makes a line that is not a "thing of beauty."

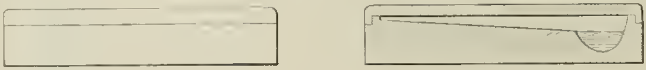
To true the points and bring to proper working order, take an oil-stone slip like the Washita stone used in the shop, close the points by means of the adjusting screw, pass the oil-stone evenly around the edge of the pen points (Fig. 1) until the edges are truly circular and of an equal profile, being sure that the flat places have disappeared. The blades are then ready for the thinning process, which is done by separating the points slightly by the screw, and laying the blades flat on the stone (Fig. 2), moving the pen with a rotary motion, the while making an examination to be certain that the point is not too thin; a true sharp edge is what is sought; one that just fails to cut the paper is right. Bring both points to this condition, and, after cleaning them, draw them over a piece of clean pine with the grain, to take off the wire edge from the inside of the points; close the points together, and taking up some ink on a writing pen, deposit it between the blades of the drawing pen, and draw a line, using the T-square or triangle. A few trials may be necessary the first time this operation is attempted, when a true line is made as fine as the pen will make, open the points a trifle and make another line a little wider, and so on until you have the widest line the pen can make (Fig. 4). If there are no signs of a ragged line in any of the trials, and if the pen feels smooth in the handling, it is all that could be required. If it is necessary to incline the pen either to or from you to make a full clear line, it is evidence of one point being longer than the other, and in that case the process of truing the points must be gone over again until both points are equal in length.

In this honing operation do not use the oil-stone between the blades if possible to avoid it; by doing so the blades soon acquire a bearing above the points on the inside, which is ruinous to the pen; care should be exercised in this particular.

In case there is a wire edge on the inside of the pen points, that refuses to disappear by the mild process given, lay the oil-stone on a table, remove the adjusting screw, and, after opening the blades, place the inside face on the stone and move the pen gently a few times, being sure the pen has a bearing on the stone back of the points.

Triangular Scale.

Fig. 3



Side View Ink Slab *Section of Ink Slab.*

Fig. 5

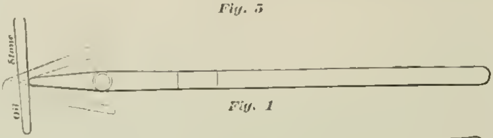


Fig. 1

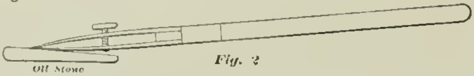


Fig. 2

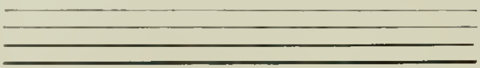


Fig. 4

Keeping the pens in working order is conceded by all to be an exasperating job, one making bulky calls on the draftsman's patience. It is certainly not conducive to an unruffled mind for one to find the pen working badly after a half hour's struggle to put it in shape.

It is difficult to convey a clear idea of "how to do it" on paper. It will be found largely a matter of cut and try.

The pens while in use will need frequent cleaning in order to have them in working condition, and more particularly as the ink dries rapidly when between the blades; fine lining is an impossibility when this occurs. To avoid trouble from this source, use any soft linen, or, better, a piece of chamois skin.

The pen should not be laid down with ink between the blades; when done with for the time always clean carefully, this prevents rust, and the pen is ready for use when wanted.

The triangular scale being graduated differently than the steel scales used in shop practice, makes necessary a description of the same. The scale for our use should read on its different edges as follows: Three inches and 1½" to one foot, 1 and ½' to one foot, ¾ and ⅜' to one foot, ¼ and ⅛ to one foot, $\frac{3}{16}$' and $\frac{3}{32}$ to one foot; and one edge read sixteenths the whole 12" of its length. Fig. 3 shows such a scale broken. An explanation of the 1" and ½' side will suffice for all. Where it is used as a scale of 1' to one foot, each large space, as from 0 to 12 or 0 to 1, represents a foot, and is a foot at that scale. There being 12 in one foot, the twelve long divisions at the left represent inches; each inch is divided into two equal parts, so from 0 to one division at the left of 9 is 9½" and so on. The 1 and ½' scales being at opposite ends of the same edge, it is obvious that one foot on the 1' scale is equal to two feet on the ½ scale, and conversely, one foot on ½" scale is equal to six inches on the 1" scale; and 1" being equal to one foot, the total feet in length of scale will be 12; at ½" to one foot the total feet will be 24.

In all the scales mentioned, one foot at each end is divided into 12 or more equal parts. Applying this description to all of the other scales, it is believed no trouble will be experienced in their reading.

If it is necessary to use a 12" steel scale, the description of above scale will assist the student in its use, as at 1" to the foot, one-twelfth of an inch on the steel scale represents 1", at ¾" to one foot, $\frac{1}{16}$ on the steel scale represents one inch. At 3" to one foot, ¼" represents one inch; so it is apparent that the steel scale will do all the triangular scale will do, but may not be as satisfactory to use, because the lines on the triangular scale go directly to the paper, making it easier to lay off dimensions.

In the first of these papers an ink slab was mentioned as one of the accessories to be provided.

It was stated at that time that stick or cake ink was the best as compared to Higgins liquid ink in bottles. Having used both, the writer sees no reason to modify his language, but it must not be understood that the liquid ink is worthless; on the contrary, it is good. When a rush is on, and every minute is worth gold coin, its value is recognized at its full by the poor but honest draftsman who has been known to rise up and call blessed the architect of the useful little compound. For our purpose perhaps it will do as well as the more expensive India ink, and make another saving in the price of the slab.

A description of the ink slab, and of the process of grinding ink will not be out of place in any event. The slab (Fig. 5) is made of earthenware, porcelain, marble or glass, and has one or more ink wells at the bottom of an inclined plane.

To prepare the ink, fill the well with clean water, take the cake of ink and rub it back and forth with moderate pressure on the inclined plane, taking up enough water at each stroke to keep the rubbing surface wet; when the contents of the well appear to be opaque enough, take a writing pen and make a few lines; if the ink is pale, rub again on the slab, and try once more, when it is black enough it will show a deep black line with more or less luster, depending on the quality of the ink. There is a golden mean to be found in preparing ink, if it is too thin it will not be black, if too thick it will be black enough, but will not run freely from the drawing pen.

To have the ink preserve its fluidity and to keep out all dirt and dust, keep the cover on the ink slab.

The mistake is often made of putting too liberal a supply of water in ink well, which causes a waste of both time and ink—time to get it to the correct degree of blackness, and ink, for the reason that what ink is left unused will dry and scale up before it can be used.

No more should be prepared than to meet immediate requirements. Fresh ink is always satisfactory when rightly prepared—stale ink, never.

A Brief History of Some Modern Locomotive Appliances.

THE "POP" SAFETY VALVE.

While the American locomotive itself has not undergone very many radical changes in the past twenty-five years, its safety, scope and utility have been increased by the developments of modern appliances attached to it.

Among the inventions especially entitled to credit in this direction is the modern safety valve, now almost universally used on our locomotive, as well as most other forms of steam boilers, and familiarly known as the "pop."

Men who ran locomotives before the invention of the "pop" will remember the trouble with the old safety valves. Younger men are, no doubt, but slightly familiar with their construction or peculiarities. The ordinary weighted valve could not be well used on locomotives, the constant jarring, and the friction of the many joints seriously affecting their proper working, so the weight upon the lever was replaced with a spring.

When an ordinary spring safety valve commences to open from the pressure of steam under it, it at once compresses the spring, bringing a greater load upon the valve, and causing it to close before the boiler had been relieved of sufficient pressure. A surplus of pressure in the boiler, above the load of the spring, is the result. If the boiler is supplying steam fast, as in the case of a hard-worked locomotive being suddenly shut off, the ordinary valve is not able to care for the surplus steam, and provisions were made on most locomotives to partially unload the valve by hand.

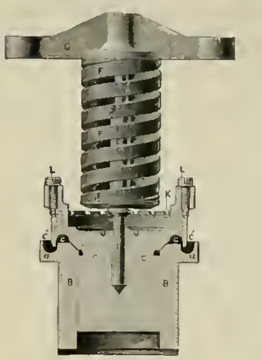


Fig. 3.

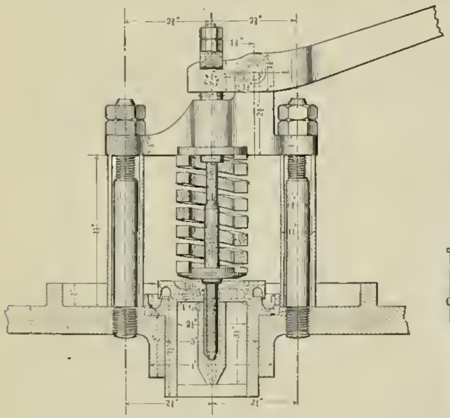


Fig. 1.

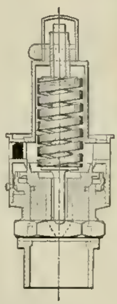


Fig. 4.

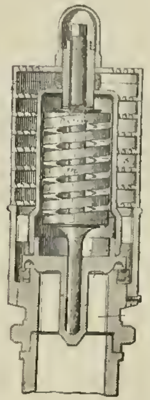


Fig. 6.

Fig. 5.

At first thought it would seem as if the way to overcome this difficulty would be to make the valves larger, but this made the matter worse instead of better; this arises from the fact that the load, the spring or weight, to hold a valve down must increase as its area, or as the square of its diameter—plainly put, to double the diameter increases the area four times, and your valve must be loaded for this area, while the area for the discharge of steam only increases as its circumference, or directly as the diameter. So the large valves had to carry a much greater load, and had a comparatively smaller opening to relieve the boiler.

These defects were well known early in the history of steam engineering, and attempts to improve the valve were many, both here and abroad.

The first attempts were made in England, early in the '50's, and were followed both there and here in the same general line.

The idea was to get a valve whose area increased when it opened, just as the tension on the spring increased.

Valves were invented with all kinds of caps and hoods on them with this idea in view, but most of them merely turned the current of the escaping steam down, without increasing the pressure against the spring.

After this followed valves in which the steam escaped from the boiler into a chamber, and there acted upon a larger valve before escaping to the atmosphere, these valves would blow at the required pressure, but would not close until they had relieved the boiler of enough pressure to allow the spring—which had been set to hold down a valve of small area—to close the large top valve against the pressure, and actually reduced the pressure from 20 to 50 per cent. Obviously this would not do for locomotive practice. What was needed was a valve that would open at a certain pressure, relieve the boiler quickly and close at a certain *lower* pressure than that at which the spring was set to open—this seemed like a mechanical paradox not likely to be accomplished.

At this time—early in the '60's—there was a locomotive engineer running on the old Troy & Boston Railroad, now a part of the Fitchburg, who got to thinking and experimenting on the safety valve problem, as he thought and experimented on almost every other problem that came up in his daily work—this was George Richardson.

Richardson figured that if he could make a valve, that had a ring around it larger than the joint, or seat, he would have an increased area, but that if he let the steam blow from under this freely that it would have no tendency to help lift the increased load caused by compressing the spring.

Then he figured that if he had another place below this cap, with an open space or cavity between them, the steam would "huddle up" there, as he expressed it, and if it could not get to the air too easily it would gain pressure and lift.

All this thought and experiment called for a great deal of patience and application, until by actual trial Richardson found that there existed a certain relative proportion between the area of the valve, the increased area and the amount of opening that could be permitted to the atmosphere.

This opening, or stricture, was discovered to be a very delicate subject, the slightest change causing a wide range of action of the valve.

On the 25th of Sept., 1866, Richardson obtained a patent on this device. The engraving on this page, Fig. 1, shows the valve as it was then made, this engraving as well as Fig. 2, which shows the valve as used with relieving lever, was made from the original drawing made at Altoona, Pa., the next year, for the valves on the P. R. R. road, where they were immediately adopted. In making these valves great care had to be exercised, and the wear of the seat or grinding in of the valve changed its range. In 1869, Richardson patented the adjustable lip, this made his invention as perfect as it is possible to make a mechanical contrivance.

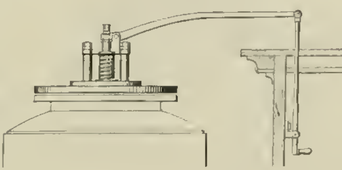


Fig. 2.

Many engineers who have attempted to adjust the amount of steam pressure reduced by the Richardson valve, have met with failure, and blamed the valve for it, because they did not understand the extreme delicacy of this adjusting ring, one notch under the screw usually being enough to make all the change desirable in service.

To reduce the stricture will make the valve lift stronger against the spring, blow longer, and reduce the pressure more before closing; increase the opening of the stricture under the outside lip will cause the valve to close quickly, without reducing the pressure so much, the best results being found when the valve closes at a boiler pressure of from three to five pounds less than that at which it opens.

The friction and wear of the old lever arrangement, and the proof that the valve was perfectly automatic, and needed no hand manipulation whatever, soon caused the levers to be substituted by the top spring, as in Fig. 3, a form of valve that has been adopted and used, the world over.

Richardson followed his early patents by many others, having taken out some almost every year since.

The commonest kind of locomotive "pop" now is the incased valve, as Figs. 4 and 5, and the latest, the "muffled pop," as in Fig. 6, this is a common valve with a series of rings around its case; these rings are drilled full of holes, the holes in one ring not matching the holes in any other ring; the escaping steam impinges from one surface to another, and is broken up into so many small jets, that it finally escapes to the air noiselessly.

Richardson soon left the road, built a little shop back of his house in Troy, and made valves. His invention was a success from the first, and met with a large sale, and wide imitation and infringement; the latter Richardson fought in the courts for years, and spent in this way a good sized fortune, but he finally came out ahead. Business crowded him, and he went to Boston, and soon after defeating Ashcroft in the courts, consolidated interests with him, and formed the Consolidated Safety Valve Co., of Bridgeport, Conn., where he is now Supt. of the works. Richardson valves are now made in all sizes and shapes, from a half inch in diameter up to a nest of five six inch valves on one base, and controlling pressures all the way from five to five hundred pounds.

The new company was very vigorously opposed in the courts, but in 1883, the Supreme Court finally decided that the usefulness of the pop valve depended entirely upon the size of the stricture, and its relation and adjustment to the valve, and that Richardson was the first to accomplish what others had failed to do before.

When Richardson first built his little shop in the back yard at Troy, the railroad boys dubbed it "Richardson's play-house," but in that little play-house, not only was the pop perfected, but the Richardson balanced slide valve invented, as well as several other devices of merit, but not so well known, and the little "play-house," has been extended, until it now covers the entire lot, and a score of planers are making balanced valves there.

This sketch would be incomplete without the introduction of another person, who was not only the inventor's friend, but his adviser and assistant—Frank Hemenway. Hemenway was a machinist in the shop, and helped Richardson work out his ideas in brass and iron, and helped make the first "pop" valve. Here was an engineer getting a friendly machinist to help him out in some "scheme," that might or might not amount to something, just as many another engineer and machinist are doing to-day.

Richardson was an inventor, and carried his inventions to something approaching mechanical perfection and a business success, saw them adopted the world over, and now rests on his oars, with a well deserved reputation, a comfortable income, and growing business. Hemenway was a student, a thinker and an experimenter; he paid little attention to making money out of inventions; he wanted to know *why* a thing did so and so, and if it did not do so and so, to make it.

Without a technical education, he soon became recognized locally as a first-class mechanic, and a good man to put up machinery, soon became Supt. of a large works, commenced to write on mechanics—especially steam engineering—for the press, and soon became attached to the staff of the leading mechanical paper in the country, and is now its editor-in-chief. His writings on steam engineering, though written in plain language for practical men, are used by the best polytechnic and mechanical colleges of the country, as text books, and in the profession of steam engineering he stands modestly in the foreground, ever ready to help those who are trying to learn, illustrating all propositions and explaining all theories by reminiscences of bits of practical experience gathered in long years in the shop.

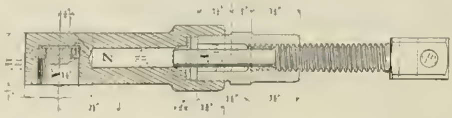
Both these men came up from the ranks, worked out their own destinies, each in a different way, yet each starting from the experiments with the "pop," both have enriched the profession of steam engineering, and both have made the world better for their having lived in it—and we don't propose to wait till they are dead, to say so.

A Piston Rod Remover.

The piston rod remover shown on this page has recently been placed on the market by Watson & Stillman, of this city. The device is extremely simple, as will be seen, the ram *X* has a leather packing at its base, and can be taken out of the head without disconnecting any of the parts, the forcing in of the screw drives the plunger *Y* into the liquid in the space *Z*, and forces the larger ram out with great power. The device is intended to be used in the space generally found between the pin of the front of main rod and the end of the piston rod.

Improved Fibrous Packing.

While metallic packing is fast gaining headway for locomotive use, fibrous packing has not remained the simple wad of hemp that it originally was.



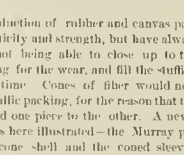
PISTON ROD REMOVER.

The introduction of rubber and canvas packings gave us elasticity and strength, but have always had a fault in not being able to close up to the rod, compensating for the wear, and fill the stuffing-box at the same time. Cones of fiber would not close up like metallic packing, for the reason that the rubber cemented one piece to the other. A new thing in this line is here illustrated—the Murray packing—here the cone shell and the coned sleeve, that comes in contact with the rod, are separated by a thin ring of brass, that prevents their sticking together, and allows the rings to retain their shape and perform their functions much the same as the same form of rings do in metallic packing.

Unlike the metallic, this form of packing can be applied to any ordinary stuffing-box without disconnecting any of the parts, and will work on scored rods. It is made by The John P. Murray Co., Jersey City, N. J.

A Factory for Steam Engine Appliances.

On a recent jaunt in New England, the writer visited the works of the Ashcroft Manufacturing Co. and the Consolidated Safety Valve Co., at Bridgeport, Conn. The Ashcroft Co. manufacture steam gauges, indicators and other fine instruments of that class, one, the Coffin averaging instrument, is an improved planimeter for measuring the areas of irregular forms, like indicator cards. These instruments are very delicately made.



IMPROVED FIBROUS PACKING.

The Tabor indicator, for measuring the power of steam engines, is an instrument of such delicacy, yet strength and symmetry, as to be of interest to any mechanic as a piece of mechanical work, aside from the results it accomplishes, which, of course, are like those accomplished by other indicators. The stock that enters into the manufacture of these instruments is so small that many thousands of dollars worth can be stored in a little space and makes little show.

The advantage of manufacturing in duplicate parts is here shown, where a very few men turn out a large amount of work in money value, through the use of special machines and jigs.

The gauge department makes more of a show. We noticed that most of the gauges built are now made on the plan of the locomotive gauge illustrated in the first issue of this paper, the entire working parts being supported on a central stand, with no connection to the back of the case.

The great care taken here to keep the test gauges right by the mercury column would make engineers suspicious of the accuracy of steam gauges in general; as carefully made as are the test gauges it is found necessary to change them very often—they are tested as often as once per week.

In the shop of the Consolidated Safety Valve Co. there is an immense stock in hand, benches and floors being piled full of safety valve cases of all sizes, from an inch to a pair of 6" pops on one stand. A description of this pop will be found in another column.

Some very ingenious tools are used here for the special work.

Expanding taps of large size, that stand up solid to the work on a huge turret head, automatically close up when the thread is cut, and allow the tool to be withdrawn without backing off.

This company occupy a portion of the Ashcroft building, using two floors, one for a store-room, the other for shop.

One department of the Ashcroft works makes adjustable pipe tongs.

The testing department of the valve works is most interesting. Every safety valve is tested under steam to the exact pressure wanted, and the amount of reduction and popping point are noted. They make pops for pressures of as high as 500 pounds.

The "Neversink."

We have to thank John F. Proctor, of St. Augustine, Florida, for two old daguerreotypes taken of the engine "Neversink" after she exploded. The pictures show both sides of the engine, the driving wheels being crowded together almost under the cylinders, and the back one on the left side gone.

The whole top of the boiler is gone, leaving the dry pipe and the flues bare.

The pictures are so dim that our engravers cannot make anything out of them.

Mr. Proctor knows nothing of the history of the "Neversink," more than that she was built at Cambridgeport, Mass. Who knows her history?

At Mobile, on the 4th inst., Mr. J. C. Clarke, president and general manager of the Mobile & Ohio road, was presented by divisions 140 and 231 of the Brotherhood of Locomotive Engineers with a unique and valuable clock. The address of presentation was made by Mr. E. L. Russell, Mr. Clarke replying in a very happy manner and presenting the engineers in return with a picture of the first locomotive which he ever handled. Of this engine Mr. Clarke said: "It is a crude affair when compared with the mechanism of the machine in use to-day. When I was first charged with the running of that engine I thought that I would not have changed places with the President of these United States. I ran an engine similar to that in 1836 between Baltimore and Washington, and distributed with it the poles for the experimental line of telegraph then being erected by Prof. Morse."—*Mobile Register.*

On the P. W. & B. they still have a good many locomotives with red wheels and gold leaf. We know it is out of style and all that, but somehow our heart warms up at the sight of red wheels. Our first love had wheels of the warmest red—she also had the coolest and calmest fire-box we ever saw.

Wm. Rymer, of Detroit, Mich., has patented the use of an air valve, placed so that when a side rod or tire breaks it will open the valve and apply the brake.

The new Suburban locomotives for the C., B.& Q. have the M. C. B. standard coupler.

The R. I. Locomotive Works.

During a recent call at the above works, our attention was directed to some splendid 10-wheelers in process of erection, these engines have but 16,000 pounds on their trucks—most 10-wheelers carry twice that load.

The practice here of using but one sheet for the wagon-top shell over the fire-box on all boilers of 78 inches or less in diameter would seem to be a practice worthy of imitation; the side seams are usually the ones to give trouble.

All seams are double-riveted, the longitudinal ones having a lap welt.

A pneumatic calking tool used here is very handy and efficient; it is in the shape of a dental hammer, the head being about 3" in diameter, and a foot long; to one end is fixed the calking tool, to the other the air-hose. The tool makes a very short stroke, but runs very fast, working something on the plan of the rock drill. The seams calked by it are very smooth, as the blows are all alike, but the noise is deafening.

Flexible shafts on each side of a boiler are used to tap out the stay-bolt holes, and then to screw in the stay itself.

A new sheet-punching machine has recently been put in, that has some new features; the punch pulls out of the work and then returns to within about a sixteenth of an inch of the sheet and stops, the feeder has his sheet suspended by a crane, with just enough upward tendency to keep it against the punch in this position, then the feeder can feed the center punch, mark with the center on the punch, and starts the punch with a foot lever, by this arrangement the punch has no opportunity to get away from the mark and spoil a sheet.

In putting in stays for the boiler heads, the front head stays come back past the center of the boiler, and are riveted to the shell, and those from the back head are fast to the boiler ahead of those from the front, so that there is no tendency of the stays to pull against each other on any certain part of the shell.

There is not much new in the machine shop, except some nut-finishing machinery. There is one machine that takes rough nuts, faces off the front and back, rounds off the corners, and chamfres out both ends of the threads. This little machine has a double head, and while the machine is doing the work on one nut the operator is putting on another above it, a trip of the head and the rough nut is being operated upon, and the finished one removed. The sides of nuts are finished by a punch that forces them through a hole, in which are arranged a series of cutters that plane off the sides. After case-hardening, no attempt is made to brighten the nuts, they are left the natural color.

In the erecting shop there were a couple of handsome little Forney engines going to some suburban railroad at Los Angeles, Cal. They were very neat, and well-proportioned, excepting the enormous bullers, front and back, made high enough to reach standard cars.

Some engines being built for the Ft. Scott & Gulf have a high nozzle with a large cavity under the tip, this to allow the steam to escape in a more regular stream, rather than by fierce pulsations.

Moulding machines are being put up and one was at work, it was turning out bodies for screw-jacks at the rate of 100 per day—a moulder formerly made ten per day

One thing about machine-moulded iron that we believe is universally recognized now, is that it is better iron to work, as the mould is rammed by pressure and is always even, an unevenly rammed mould will make an uneven casting.

In taking the flasks from the machine, a trolley runs down a track the length of the floor, and every few feet there is a cross track; an ingenious switch allows the trolley to go to any of these tracks or pass any of them.

These works have always made their main pins without a collar between the main rod and the side rod, giving full length of pin for bearing. They have recently commenced to make the bearing next to the wheel, slightly larger than the outside bearing, especially where solid-ended rods are used, as it makes it easier to disconnect on the road

Recognizing the value of balanced valves, they now put them into all locomotives built, whether ordered or not—unless ordered without balanced valves.

"Strange, Passing Strange."

"The Big Four is testing a large double-boiler locomotive, built by Hinckley & Co., of Boston, on the Indianapolis division. The locomotive, including tender, is 85 feet in length and weighs 130,000 pounds. There are two large boilers, between which the cab is situated. Two engineers and a fireman are required to run the locomotive. It is claimed the locomotive has made a speed of 93 miles an hour."—*Ry. World.*

Our 'steemed contemporary don't seem to recognize the Strong engine—suppose the extra boiler and engineers threw them off the scent.

Melting Metals with Oil Fuel and Natural Draught.

At the works of the Deoxidized Bronze Co., at Bridgeport Conn, they melt their metal with oil, using it in a manner altogether different from anything we have ever before heard of. They melt their copper in a Siemens furnace, which is simply a shallow dish with a cover on it. This furnace is large enough to hold 8 tons of molten metal, it stands up from the floor, and is probably twice as long as it is broad, at one end there are two fire-doors, at the other a flue to the stack. In each door of the furnace is located a metal dish about six inches wide, and a foot long, not over an inch deep, there is another dish inverted over this, that has a slot in its top; in charging the furnace no fuel is placed with the metal, but enough wood is placed under this little dish (which projects in from the door) to heat it pretty hot, when the pans are hot the crude oil is turned on and simply *drips* into this hot dish; it is never allowed to run in a stream, yet the blue flame from it is a steady blaze at the stack, ten feet beyond the furnace. The air is admitted right on to the pan, the door being arranged to leave a slot in the center. With this simple and inexpensive arrangement they are enabled to melt a full furnace of bronze in an hour and a half.

Perhaps the oil burners tried on locomotives have been too elaborate. Still, we do not expect to see oil used in place of coal to any great extent on locomotives, even if it was a success and easy to handle. It would soon become scarce, and the Standard Oil Co. would boost the price too high

Activity in Locomotive Building.

Some indication of the condition of the locomotive manufacturing business may be learned from the results of calls for bids for locomotives for the Lake street elevated road, Chicago. It seems that some difficulty was found in obtaining locomotives on the desired dates. It was found that of six locomotive works, two were too full of work to make bids; two could not furnish locomotives until May, 1890, one could furnish some in April, and only one could furnish two in January, two in February, and six in March.—*Railroad Gazette.*

This holds good only of those concerns who are up and doing. There are one or two concerns that have no work on hand at all, and with their present facilities cannot afford to take any

Thirty years ago, on the old Troy & Boston road, they had extension fronts. Wood burners were used, with the old balloon stacks having an inside pipe and a cone over it, the cinders being caught in the large part of the stack. The extension was made of thin iron, and was bolted on ahead of the arch, there being about a two-foot opening into the original front. From the bottom of the large part of the stack, a pipe led into the extension, to allow cinders to run into the front. This early extension was named by the men, the "sub treasury."

On the N. Y., P. & B., we recently observed some engines where a pair of Sellers re-starting injectors were set side and side just above the running board and outside of the cab, both branch pipes being arranged side and side. The cab was wide enough so that the engineer had a stool to sit on beside the boiler

He Ran on the Signals.

In some of the southwestern territories there was, if there is not yet, a law requiring a report to be made to the county officials of all stock killed, together with a description and the "brand" the animal bore.

A great deal of delay was caused by trains having to stop to allow trainmen to look at the brands of stock killed, as it was a grazing country and the roads unfenced. Naturally the officials of the road fought against the law in every trial, but kept up the order to obey it, at the same time pulling men off if they failed to make time—stock or no stock.

One of the superintendents on a certain line had some blooded stock of his own, of which he was very proud, and it was pretty well understood that it would go hard with the man who hashed up any of the short-horned herd.

One old runner, who had enough of a record as a stock killer to have the wipers dub his engine "the slaughter house," was coming down the hill one day, right through the superintendent's ranch, and there on the track stood the prize bull of the whole herd

This engineer was given to the habit of talking to himself. On sighting the bull he put on the air and slowed down his train, remarking, half to himself half to the bull

"Look out there, old man, I'll make a muley of yer."

At this, Mr. Bull lowered his head and pawed up a scoop of gravel from between the ties.

The locomotive was hauled right down to three miles per hour, as the engineer remarked "Oh, no! I don't mind fightin' you, but you and the old man (the superintendent) both are too much of a good thing"

Here the bull turned and ran ahead of the locomotive and beside the track.

"I knowed you'd think better of it," remarked the runner, as he released his brake and commenced to work steam.

The train had almost stopped, and by the time it was going six miles per hour the bull had got some distance the start, but, as the engine neared him, he got onto the track again.

The engineer shut off, remarking, "Yer monkeying with the loaded end, Mr. Bull."

The bull stepped off

"Changed yer mind, hey?" and the throttle was opened easily.

Again the bull took the main line

"So ye've changed yer mind agin, have ye? Well, so have I!" announced the engineer, as the throttle made a jump for the tank, and the sand lever came back with a snap.

In four minutes the old Pittsburgh hog was "all mussed up", there was hair on the pilot, and short horned bull beef in the ditch.

The engineer expected to get sixty days off, if not his final discharge, and so made no report. A trip afterward he was called up on "the green carpet," to face the maddest superintendent in America.

"So you couldn't content yourself a killing eight or ten mavericks a trip, but you must kill my short-horn bull, hey!" roared he, "cost me a clean six hundred dollars, sir! six hundred dollars—and you have the brazen impudence to come up here and ask me what I wanted to see you about"

"Look-a here, Captain," coolly remarked the plug puller, "what bull are you talking about, and who's killed any of your bulls?"

"Oh! you can't come any of that talk, you, sir, you, killed my six hundred dollar bull, and you know it."

"Don't know nothing of the kind."

"Don't know nothing of the kind, hey? ain't satisfied with killin' my bull, then violating the rules of the road by not reportin' it, and disobeying the laws of the government by not reportin' the brand, but ye must lie about it, too! Now sir, do you dare to tell me you didn't strike my bull?"

"Now, that's more like it," remarks the runner, "striking and killing is two teetotally different words. I did meet your bull on my time, but he turned over so easy I was surprised, and was going to stop and go back to get his brand, but I got a signal to go ahead and went."

"But the conductor and brakeman say they were in the caboose and knew nothing of it, there wasn't any signal to go ahead."

"What's that?" asked the runner, as he stood up and waved his hands violently, as if he was trying to fly.

"Go ahead, all right signal," nodded the superintendent, "but who give it to you?"

"Well, when I hit the bull, I looked back and put on the brake, was going to get his brand, but the bull was laying on his back givin' me signals with all fore feet to 'go ahead, all right,' and I reckoned he was all right and went. I run by the rules, I do, and you can't blame any man for that."

Know Your Business.

Mr. Vanderbilt pays his cook $10,000 a year, my boy, which is a great deal more than we get—*because he can cook*, that is all. Presumably because he can cook better than any other man in America, that is all. If Monsieur Saucegravi could cook tolerably well, and shoot a little, and speak three languages tolerably well, and keep books fairly, and sing some, and understand gardening pretty well, and could preach a fair sort of sermon, and know something about horses, and could telegraph a little, and could do light porter's work, and could read proof tolerably well, and could do plain house and sign painting, and could help on a threshing machine, and knew enough law to practice in justice's court of Kickapoo township, and had once run for the legislature, and knew how to weigh hay, he wouldn't get $10,000 a year for it, he gets that just because he knows how to cook. It wouldn't make a cent's difference in his salary if he thought the world was flat, and that it went around its orbit on wheels. *There's nothing like knowing your business through*, my boy, from withers to hock, whether you know anything else or not. What's the good of knowing everything?—ROBERT J. BURDETTE *in Pathfinder.*

[This was written especially for railroaders.]

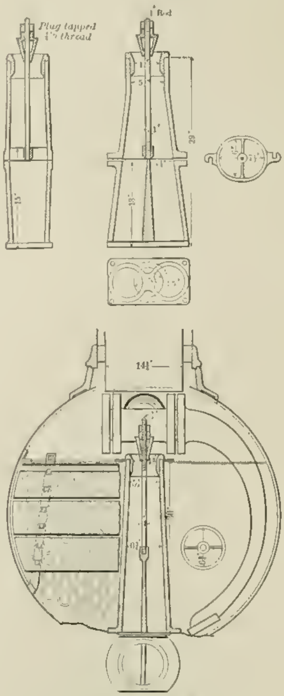
The engineer, fireman and head brakeman on a coal train on the N. Y. S. & W. were killed by their engine and twenty coal cars going into the drawbridge over the Hackensack river during a blinding snowstorm on the 14th of last month. If the road had been blocked, or the train been provided with brakes, or the usual precaution of coming to a dead stop for draws been used, the accident could not have occurred. The way heavy coal trains are turned loose on some of the eastern roads, without adequate brakes, and on lines crowded with traffic, is reckless, to put it mildly. Automatic brakes and automatic couplers would do much to make life a little bit safe around them—which is more than can be said now. When a herd of cattle get the distemper the whole district is quarantined until the disease is cured. Some day the people will quarantine against those roads that are more than half a century or so behind the world in life saving improvements—then the roads will yell, "Granger."

The New York Railroad Club has been thoroughly reorganized with Ross Kells, Supt. M. P. of the Erie, as president, and L. R. Pomeroy, secretary and treasurer of the Suburban Rapid Transit, as secretary. The headquarters will be moved up town, and with the January meeting will be commenced the discussion of live railroad topics. That this club has a large field, practically untilled, goes without saying, and with the present officers in charge, and a goodly company of volunteers, the club ought to become the source of much valuable railroad information.

Thos. Paxton, who was roundhouse foreman at Nickerson, Kan., last year and took a great interest in getting the railroad men to read THE LOCOMOTIVE ENGINEER, has since been appointed master mechanic of several divisions, having more than a thousand miles of road to keep mills in shape on. He is just as enthusiastic a LOCOMOTIVE ENGINEER man as ever.

We are in receipt of a neat little pamphlet of 84 pages, that is being given free to the men on the Pittsburgh division of the P. R. R., by the P. R. R. Dept. of the Young Men's Christian Association, at Pittsburgh. The book contains many rules in case of accidental injury, drowning or poison, the rates of postage, specifications of several classes of P. R. R. locomotives and cars, a list of the block stations, and other information of a like character, that cannot fail to be of interest to the men for whom the book is intended. M. W. Callender, gen'l sec'y, has charge of the distributing of the work.

At the new roundhouse of the N. Y. & N. E. road at South Boston, we observed that the bottom of the pits was made crowning, so that water would naturally run to the sides instead of the middle, as usual. No doubt the men who have to do work in the pits appreciate this—they ought to.



EXHAUST NOZZLE EXPERIMENTS

Correspondence

Some Exhaust Nozzle Experience.

Editor The Locomotive Engineer:

I enclose you blue prints of an exhaust pipe with the cone in the pipe. We use two patterns of exhaust pipes to suit the different types of engines.

We have one pattern we make in two parts, which makes it very easy to put in, and also to take out to clean out the pipe and nozzles when they become stopped up. This is a matter that is often neglected when it is difficult to remove the pipes, they being only cleaned out at the top, and the lower part left closed up.

In this pattern the partition between the two openings is run up 2" above the joint, giving an opportunity to drill and tap out the holes in the bar for the rod which holds the cone. While the openings or passages may seem made for large engines, they are all considerably in excess of the port area and the passages through the cylinder and saddles, giving easy and free passage for the steam to the nozzle opening. The area of the bushing being almost equal to the port opening, reducing the possibility of back pressure. As to there being any special merit or value in this device in the operating of our engines having it in, we have not determined by any comparative tests, by getting at the actual consumption of coal or evaporation of water. But by practical observation, and the experience of the engineers running their engines before and since the cone was put in, and pipes changed, we are satisfied they burn less coal, run much freer, and steam better, burning an even fire. We have put them in some engines burning anthracite and bituminous coal; so far they work very satisfactorily.

I think this is an interesting and an important part in the matter of economically and efficiently running locomotives, and one in which the details of the draught plate, size of stack and grate area are important factors; and then adjustments are not always properly looked after to suit the requirements of the condition or class of engines to which they are applied when the form of boilers is different. On this subject the point was well illustrated by some remarks in your paper some time ago, where it was noted a boiler maker's helper was engaged in or left to adjust the petticoat pipe, while a machinist's foreman was splitting hair setting the valve. As a result, a good working engine was being stalled for steam, because proper attention was neglected in attending to an important matter. In such cases, smaller nozzles are often resorted to as a remedy to make steam, at a detriment to the working of the engine.

While it is not always possible to arrange the apparatus or parts of a front end, so engines will always steam free, investigation and experimenting will often show that improvements can be made in the proper direction.

The idea in making this device was to spread the exhaust so that it will fill the stack at the base.

WM. MONTGOMERY.

Manchester, N. J.

[We have received a number of letters asking for details of arrangement of the coned exhaust, and Master Mechanic Montgomery, of the Central Ry. of N. J. has kindly furnished the drawings of device in use on that road. The nozzle-stand that has a joint in it would seem to be an improvement in any long pipe to facilitate cleaning.]

Little, but Lively.

Editor The Locomotive Engineer:

In the last number J. A. M. tells of some fast runs made on a two-foot gauge road—the Bridgton and Saco River—and asks if any of the readers can beat the time, considering the gauge. How is this: Weight of engine, 12,000 pounds, size of cylinders, 6"x10"; diameter of driving-wheels, 24 inches; gauge of road, 2 feet. Engine built by H. K. Porter, Pittsburgh, Pa. Started from a state of rest and run light 5,700 feet in fifty (50) seconds.

Jamesburg, N. J. J. D. B.

A Licensed Engineer's Ideas.

Editor The Locomotive Engineer:

In Mr. Cushing's questions about breaking side rods on a six-wheeled engine, he says if you break a back connection you take down both back sections of the side rods and leave up the front sections.

C. H. Reynolds says that Mr. Cushing's answer is, when you break a back connection you take down both back rods, and when you break a forward connection the rods are left up. Mr. Cushing does not say that, he says if you break the back connections, take down both back parallel rods, and if you break the forward connections, why, take down the whole line of parallel rods on both sides and run in without train, and when you break a back connection, take down both back parallel rods and leave up both front parallels, and run in with about two-thirds of your train. Mr. Reynolds must look over the questions again and put on his glasses. I have been running a six-wheel connected engine for the last two years, and I know better than that myself. I hope he will look over the questions more carefully next time, and see what Mr. Cushing says before he makes a break. I do not find any fault with Mr. Cushing's questions; they are only for young engineers and firemen, but old engineers can learn a great deal from them. Mr. Cushing's new rules are not new to us down South, for we have been examined and have our licenses. We are all licensed engineers down here, that is where we are ahead of the engineers, in the Northern and Western States. A man has to be a first-class engineer before he can ride an engine, down here. We have a book of rules to study on railroading, and have to run a train and to protect it. They are strict on us. D. W. COWAN.

Wallace, Ala.

[Mr. Reynolds and Mr. Cushing were both talking about what to do with side rods in case of broken *tire*, not rods. Our Alabama friend got his specs on wrong. What kind of an examination do they give you when you apply for a license in Alabama? Cannot our correspondent give us the list of questions?]

Color, not Shape.

Editor The Locomotive Engineer:

In the December issue I noticed some remarks under the head, "None so blind as those who will not see." I don't see where the curious part comes in; it was not the *shape* of the board, the man was to look to, but the *color*. Suppose the management saw fit to put up a *square red* board. Would that be any reason the men should not stop, when that square red board should become sleeted? Suppose that round red board with a round hole should get its shape from that same sleet and snow, and should become the form of the white board—what then?

I know a man who had run an engine over one year, and was asked, one day, if the guide was tapered on the 248; he didn't know; he was also asked if the guide-bolts were put *up* through the guide or *down*—if the nut was on top or bottom—he could not tell, hesitating, stopped, and tried to think. Now don't condemn the man as an engineer, for he was one of the first class. I took the matter up and interviewed several engineers about different parts of their engines with the same result.

There was nothing said about shape, in the rules directing the men's attention to the boards, it was color all the time. If the *color* was not there, they were to *stop*, and that settled it. I am an engineer and a reader of THE LOCOMOTIVE ENGINEER. WM. LANSING.

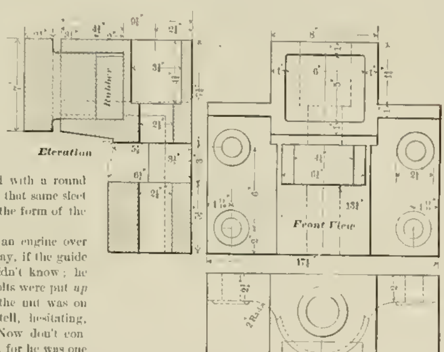
Clinton, Iowa.

[According to this, an engineer would be entitled to go, if the danger signal was against him, but *white* with snow. Of course the rules should mention the shape of the board, but the shape is a help and a safeguard to those who notice it—helps to *make sure*. We should sooner expect men to be unfamiliar with parts of their engine—they do not build or repair them—they *handle* them, every one of those men could tell whether the reverse lever handled easily or not, whether the sand lever was close to a steam pipe or the injector or break valves reachable. These are the parts vital to their work. The signal board is also vital to their work, and on its proper handling *and observance* not only their success, but their lives depend. We were surprised that they did not note the shape, and are surprised yet.]

Improved Draft Castings Between Engine and Tank.

Editor The Locomotive Engineer:

I send you a print of a front draw-head casting and buffer for tenders, which has proved to be of great value on our engines. The strain on the draw-bar of an engine coupled in the common way with solid buffers is very great, especially on crooked roads and short curves, in some cases almost sufficient to shear the pins partially, or else throw the trucks from the rails. And when we think of the very great leverage which the tender exerts on curves—on the draw bar and pins—we don't wonder that they so often have to be taken up or wedges placed on engines for the purpose of taking up the slack between the engine and tender. With this draw casting and buffer, as represented in this drawing, all this trouble is obviated. The draw-bar always remains right and the pins are never sheared. You will observe that the draw casting on the tender has a pocket or recess into which the buffer is placed, behind the buffer is placed a large piece of rubber. When we couple an engine and tender together, we compress this rubber behind the buffer about ⅝ of an inch, which we have found to be about right for our work. We have no trouble with our draw-bars, and there is never any slack between the engine and tender, and in going around curves the rubber relieves the great strain from the pins and bar. We took out a draw-bar after running 18 months, and found it in so good condition that we put it up again and run it until the engine came in for general repairs. That is our usual custom now. We never (except in case of an accident) trouble the draw bar between engine and tender. I ought to say, however, that the buffer castings on both engines and tenders have chilled faces. Sometimes the chill is not



IMPROVED DRAFT CASTING.

very good and they wear off, but they can easily be replaced with the buffer casting represented, which is another thing in its favor. But the draw-bar and pins are never interfered with, except, as I said before, in case of an accident. This draw-casting is the invention of the foreman of our shop, Mr. Russell Hawkes. All our engines on the Worcester Division, N. Y., P. & B. R. R., are equipped with them, with the above results, and some of the Boston & Albany engines have them on. Mr. Hawkes did not take out any patent on it, and has generously allowed it to become public property.

Providence, R. I. W. FOSTER.

A Kink on Disconnecting.

Editor The Locomotive Engineer:

We all know that it must be very unpleasant to have a valve or valve yoke break, especially when the throttle leaks, and steam chest casings solid cast iron, and in one piece, quite a job to take off casing and cover, and replace valve over ports; don't do it. Open smoke-box door, loosen tip on broken side, and slip in a saw blade, screw down bolts, disconnect as usual, and go on.

This is for short front ends, for the extension front end, with double exhaust, take all of the bolts out of base of stack, but one, slew the stack and put in a plug. This plug should be made beforehand, about 10″ long, larger than the pipe at one end, and 2″ at the other, sawed in two in the middle, then by dropping the large end down the exhaust you can then slip the other half down and pull up hard, and it will stay when the steam is on, you can have a hole and a pin through them to hold in place.

Saratoga, N. Y. C. F. G.

How is This, Old-Timer?

Editor The Locomotive Engineer:

Having read an article in the December number of your esteemed paper, entitled "Bound to Work," by your "Philosopher," suggested by information purporting to come from "An old-timer from the luckiest county in the land of hard cider and granite" (which last, by the way, I should judge might be so, especially the "hard cider" part), I would crave permission to correct some of the statements therein contained:

Firstly—There never was a valve made "to go into a pipe between the cylinder cocks" of any engine on the Norwich & Worcester R. R.

Secondly—The old Hinckley insider "War Eagle" never existed on the N. & W. R. R. during the 28 years Mr. Colburn was M. M.

The locomotive "Wauregan" (the only name on the road which by any possibility could be "twisted" into "War Eagle") was built by the N. & W. R. R. Co. at their shops, while Mr. Colburn was M. M., but was an outside connected engine, and had no valves of the kind mentioned by "Old-Timer." A valve was invented by Mr. Colburn, which accomplished the work for which it was intended, and was abandoned in a few years for another of his valves, which cost less to make. These valves were intended to save fuel, and the records of that time, compared with those of other railroads, show they performed their duty well. Being well acquainted with the N. & W. R. R., its motive power, and the man mentioned, and that, too, for many years, I beg the privilege of correcting the misapprehension under which your "Philosopher" seems to be laboring.

It is always fair to hear both sides of a question, and as the "truth" is always desirable, I have taken the liberty of sending this communication, hoping it will be kindly received. I run a locomotive on the N. & W. road for twenty-five years, and am therefore entitled to be called an "Old-Timer" from the

Norwich, Conn. "NUTMEG STATE."

On Studying Indicator Practice.

Editor The Locomotive Engineer:

I admire that fireman who has Pray's second volume, but don't like his wholesale charges of ignorance of locomotive engineers; there are exceptions to all cases. He is, no doubt, trying to learn something besides firing, which every fireman should do. All of us employed in steam engine service of any kind should appreciate the fact that we have the experience of such men as Thomas Pray, Jr., to draw knowledge of practical experience from, let their light shine. I get all such books I can afford, and value them highly—they have done me some good, they can do no harm.

The indicator has come to stay, and valve adjustment will be more governed by the indicator cards in the future than punch-marks and trams.

"Twenty Years with the Indicator" nor any of the books of its class contain any Latin or anything too deep for a practical man to study out, and nowhere furnishes an excuse for a locomotive engineer to run into a switch, or any other engine, but does show the real action of the steam in the cylinder, and that is something we all want to know about. A locomotive engineer who is running a fast express train over a first-class road carries his water so high in the boiler that he has to throttle his engine to prevent it from coming out the stack. Now if a card was taken from his engine running that way, and was shown him, and he could read the card, do you think he would continue to run that way and wonder why he could not make the time?

Of what use is all this knowledge to a locomotive fireman, you ask. Well, the firemen are the future engineers, and the more he knows about his business the better. We should all strive for something higher, and while all of us will not get there, knowledge will be no detriment to any one.

Philadelphia, Pa. PROGRESS.

The Oldest Man.

Editor The Locomotive Engineer:

In a late number of a mechanical paper, under the head of "Wanted," was a call from a Cincinnati establishment for two men for a certain class of work They were to be *live* men and *readers*, who keep themselves posted and abreast of the times. Now if these particular points are essential, together with mechanical ability, in our manufacturing establishments, why does not the same rule hold good on our railroads? Boys, just stop and do a little thinking, for just as sure as the sun shines, the day is coming, and is not far off, when the question will not be asked, Who is the *oldest man?* but Who is the best posted, other things being equal? It is going to be the reading, thinking, practical locomotive engineer, who will handle our fast express and mail trains, and a civil service examination is going to find out what you know, and what you do not know. The oldest man humbug is going to be one of the things of the past. I have nothing to say against the veteran engineers as a class, the most of them are good enough for the present, but things and ideas are advancing. Are you, the oldest man, keeping step with the times? You may think your "Post" or "Kelly" headlight is good enough (and they are good), but they must step down and out, and make room for the electric light; it is the coming light, and will not need to be assisted by any of the lesser lights. There will be a little dynamo put on your engine, perhaps right in your seat-box, and you will have to run the thing, you will begin to have trouble with it; your headlight flickers and don't show a steady light, you will have an incandescent light in front of the steam and air-gauge, and it gives trouble, you look all over the wires but discover nothing; your fireman makes an examination and finds the wires have been chafing, and the insulation is gone in places, allowing the wire to come in contact with a bolt or nut, or some parts of the engine, thereby weakening the current, or the filament in the gauge light is fractured, making that light refuse duty. Do you see the point? your fireman is "abreast of the times," and is going to step over on the right hand side in the near future.

Men are going to get the best runs not only for what they can do, but for what they know in addition. What with sight-feed lubricators, air brakes, steam heating, extension fronts, signal codes, electric lights, injectors, etc., men must be up and doing. You young runners don't waste your spare time sitting in the roundhouse talking railroad; leave that to the fossils; rather get some good book or paper pertaining to your business. Read up, or you will be left behind in the race; you must step in and take the place of the "oldest man." But you say you cannot content yourself reading, but you must acquire the habit, if you ever intend to make your mark, try Jules Verne's "Twenty Thousand Leagues Under the Sea", if that book don't amuse and instruct you scientifically, and give you a taste for scientific reading and a desire to be further posted on compressed air and electricity, then you are cut out for a switch or work train engine, and will have to give up the good things to the boys who have outstripped you. But don't forget to let whisky alone

W. DE SANNO,

Corry, Pa. Engineer and Machinist.

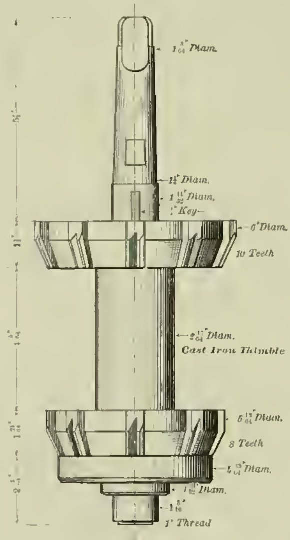
[This is far different advice than that usually given by men whose experience dates back to the time when Baldwin's "Old Ironsides' was one of the finest express engines in the country.]

A Throttle Reamer.

Editor The Locomotive Engineer:

I enclose a print of a throttle valve reamer which we made. The cutters are inserted in soft steel disks, in the usual way, but you will observe that there are two teeth in every piece. This makes the reamer work steadier and smoother than one cut would do; it has been thoroughly tried and works well. Inserting teeth in this way is very much better in large cutters than making them the old way of tool steel and cutting the teeth. I find there is great risk in the hardening of large cutters, very often they are spoiled by fire-cracking. You know the tool maker may take all the pains possible in making tools, which may by improper working or heating be almost useless, to the great disappointment of the tool maker, and great expense of the owners. I remember several such cases in my experience, but in this case there is very little risk, and the work can be done fully as cheap; the cutters can be driven out, hardened, then driven in and ground, and good work done without any doubt. WM. FOSTER.

Providence, R. I.



THROTTLE REAMER

Only One Bright Spot—Tired of Rawhiding.

Editor The Locomotive Engineer:

Have just been looking over some back numbers of your valuable paper with pleasure and disgust—pleasure, when some article would refresh my memory of some good points forgotten; disgust, when I would read of indicators, air-brake practice, performance of new engines, fly runs, etc., because I am denied all these.

I deplore the system here, because it is "chain-gang" and tough, twenty-five or thirty men running sixteen or eighteen consolidators. Being short of engines we usually leave late, then "hit 'er" to get somewhere. Had we regular engines am sure I could look with some pride on the coal and oil report. Can't do it now. Only for THE LOCOMOTIVE ENGINEER I would know nothing of the new engineer's brake-valve, quick-acting brakes, indicators, and many other new inventions. None of our freight engines have air, some have steam brakes, but on account of neglect are not of much use. I am not getting too large for my clothes, or too nice to pull freight, but I often sigh for something different, new and progressive. Reading of them is good, but that isn't satisfaction. I would like to see, feel and have experience with new inventions, and keep up with the times. How can the efficiency of men be got at where the only thought and desire is to "get there"—no thought being given to fireman or self, coal, oil, or engine? What use for me or others to aspire to something better or higher? If a man comes and goes without breakdowns or other mishaps, others call him lucky instead of giving him credit for vigilance or carefulness. I fired up north five years, and had to pass a rigid examination before promotion, but much I learned there is laid aside here for "rawhiding." I wish more M. M.'s, foremen and engineers read THE LOCOMOTIVE ENGINEER YOUNG RUNNER.

Nashville, Tenn.

[Don't give up hoping for improvements; they will come and those "lucky" men who "get there" without mishap will come out on top in the end. Managers have a liking for lucky men—no matter what causes the luck. Try to be lucky.]

Testing the Compound Principle for Locomotives.

Editor The Locomotive Engineer:

The B. & O. compound is still running between Philadelphia and Baltimore, but is now running freight, and has not, I understand, equaled the sanguine expectations of its many friends; the "why and wherefore" of its failure to do so is "what no feller can find out." But from the fact, or rumor, that the "Baldwin Locomotive Works" are making a new pair of cylinders, it would appear that there was still room for improvement. What the change will be is a mystery to the uninitiated. Why do they always saddle a new type engine with so many "improvements" of untried value, and thereby increase the risk of failure? Why not try this type of compounding with the old D slide valve in place of the "improved" piston valve now used, and at the same time apply a piston valve to a standard engine, and ascertain beyond doubt whether the trouble was in the "compound principle" or some of the details, the piston valve among the number? It is not giving a new thing a fair show when it is tried with several others at the same time, as in this case—a sliding bar to connect the link to valve rod, in place of the rocker arm of almost universal practice, being among the number, and this bar has given more or less trouble up to date. It has also a variable exhaust of what is known as the "solid plug" type, which has been in use ever since way back in the fifties, and was in all cases laid aside for the pipes with openings to suit each cylinder, and the piston valve seems, to the many who have seen them tried and condemned, a very doubtful expedient.

This is too much to saddle on the principle of compound locomotives, which has a hard battle to fight with prejudice in this country, and will have a hard road to travel in making itself popular, without being handicapped by any doubtful improvements.

The Webb compound on the P. R. R. has many objectionable features attached, but it would be well to find out why they are used before changing to something untried It may be possible that their use has been well considered, and their objectionable features more than overbalanced by their advantages.

Before trying to improve upon anything it is well to understand the subject fully, so we can see why things are "thusly."

The "Webb" has beyond all doubt shown a saving of fuel over the ordinary engine, and the B. & O. has not. Is it the principle or the improvements that are responsible for this, or can it be that there is something about the Webb besides the compound that does the saving?

Conshohocken, Pa. O. B SERVER.

A Radical View of the Traveling Engineer.

Editor The Locomotive Engineer:

From the article in your paper on the Traveling Engineer, it seems to me that some fellow must be traveling for a job, or else some road must be employing an incompetent M. M., and at Mr. Phelan's idea of letting a M. M. paddle his own canoe I am surprised. A practical engineer ought to know that any M. M. who allows a traveling engineer is not held in position on account of his good qualities as a mechanic or engineer. Did you ever know of a good practical engineer, as M. M., who would employ a traveling engineer? Well, I guess not, unless a friend of his come along and he has all the engineers that he can employ, then he picks up the idea he can employ him for traveling engineer; but as soon as he can give him a regular engine, good-by traveling engineer, until some other friend comes along. No master mechanic who knows the duty of an engineer will employ a traveling engineer. I am surprised that any superintendent would admit anything of the kind to be paid for on transportation rolls; but as long as companies will employ incompetent men for superintendents and master mechanics, such ignorance may be expected as employing traveling engineers. I do think, in my own opinion, that money paid out to a traveling engineer is worse than that of paying out money for cylinder oil that makes 5,000 miles and requires new valves and false valve seats for the engines, also new packing for cylinders. A master mechanic should know the duties of an engineer before he accepts the position of M. M.; then a part of his duty is to know the condition of all his engines in his charge. His next duty is to keep those engines up in good repair, keep their valves square and packing from blowing. The engineer's record as to how he pulls a train, and handles his engine, will soon tell on him, then the M. M. can handle him without any go-between—called a traveling engineer. When a M. M. does not know the duties of an engineer, I would advise him to employ a fireman that does.

Now, Mr. Editor, this will hit some M. M.'s pretty hard, but you just tell them to take my advice as to employing a fireman.

I have been a traveling engineer in pay of the company, and I have also been a traveling engineer without any pay, and I think in my own mind that railroad companies were making more money when I was traveling without any pay, and common engineers were happy.

I am very much pleased with your valuable paper, and I hope you will continue in the good work and swell your subscription to what it ought to be. Every engineer, every railroad official, and every employe of motive power and car departments ought to subscribe for it.

E. A. CAMPBELL,
Supt. M. P. & Mach'y H. E. & W. T. and S. & H. Railway.
Houston, Tex.

A Flue-Hole Cutter.

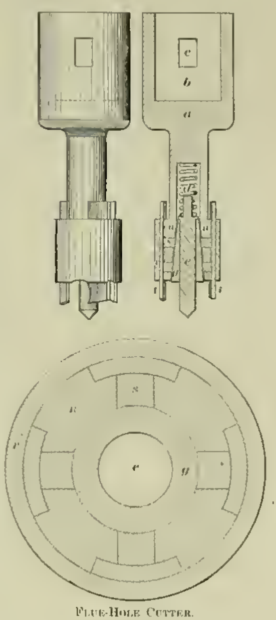
Editor The Locomotive Engineer:

Enclosed I send you blue print and description of a very practical device for cutting all sizes of flue sheet holes.

Consisting of a shell *a* keyed to the outside of drill spindle, so as to make it more durable, and prevent it falling to the floor after every hole, which would damage the tool and cause unnecessary repair, and also to keep drill master in good humor.

The cutter holder *n* is turned the size required, being in this case $2\frac{1}{16}$" scant, the bearing of cutters, four in number, are $\frac{11}{16}$x$\frac{5}{16}$" deep, and the cutters scant of $\frac{5}{16}$" accurately fitted in the slots. The cutters are secured by means of steel pins *s*, two for each cutter, and taper bushing *g* pressing against the inside of bushing *r*, which is shrunk to the body *n*. The center *e* is the guide of cutters adjusted by spring *d*. For grinding the cutters, remove *e g* by means of a slot provided, similar to a drill socket, which is not shown, and the cutters can be taken out and be replaced or refitted when necessary. The cutting edges of cutters should not be ground straight, the follower or second cutter should be about 2° taper to the first one, the third like the first, and the fourth like the second, thus relieving the cutting and making a smooth hole. A case of weak feeding attachment on drill press, where the cutter would not do work required, caused by the additional friction of the same or spring *d*, remove *e g* and put a common reamer corresponding with the same taper as *g*, drill the small holes first and operate the cutter in the same manner. For enlarging the size of holes use the same shell and make offset cutters. With this cutter we have been able to cut 200 holes in 10 hours.

C. G. BRETTING.
Brainerd, Minn.



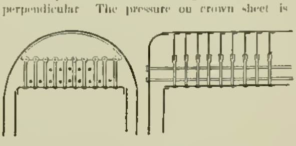
FLUE-HOLE CUTTER.

A Suggestion on Crown Sheet Stays.

Editor The Locomotive Engineer:

In thinking over the different methods of staying the crown sheet, the following idea presented itself. Instead of using the double crown bars fastened to the crown sheet, with stays to outside shell, I suggest single flange plates riveted to the shell, as shown in sketch, with stays to crown sheet.

The stays being of the same length and hanging perpendicular. The pressure on crown sheet is



carried through the stays and distributed over the plates to outside shell. Longitudinal braces could be used with more advantage, and the crown sheet can be cleaned as easily as in the Belpaire fire-box. The shape of boilers with flat sides above the crown would be better preserved.

New York City. MANHATTAN.

About the Air-brake Puzzle.

Editor The Locomotive Engineer:

SIR: I have waited to see if some expert would not explain the "Air-brake Puzzle" of Mr. C. A. Smith in the September issue of your paper. I did certainly think the "air brake" would draw attention fully as much as some other subjects that have been discussed.

Now by your permission I will endeavor to explain to Mr. Smith the "reason why." With eighty pounds pressure and stop-cock closed, we open stop-cock; this lets the air from train pipe into pipes leading to left auxiliary, and by way of extra pipe to tender brake cylinders, setting tender-brake in opening the stop-cock, you reduced pressure in train pipe; this caused triple valve to open port from tender auxiliary to brake cylinder. So you had first the air from auxiliary into brake cylinder, as the air had a longer distance to travel by way of stop-cock and extra pipes. Now we have the pipes, tender-brake cylinder and both auxiliary filled with pressure a few pounds below what it was when we opened stop-cock. As soon as pump has furnished the eighty pounds again the triple valve of tender will be pushed in position it is at release. This will cause a blow of air from exhaust port of triple valve. This will continue as long as everything remains as it now is. Right here probably is where Mr. Smith changed position of four-way cock under tender. Changing it stopped the leak of air, but made no other perceptible difference. Changing four-way cock from automatic to straight air closes port leading from auxiliary to brake cylinder, and opens port direct from train-line pipe to brake cylinder. So we will place four-way to automatic, and we have the leak of air. Now close stop-cock and the supply of air is cut off, so as soon as air stops blowing through exhaust the tender-brake will be released. This is taking air from pipe leading to left auxiliary, and the driver-brakes are set. You can release driver-brake either by bleeding auxiliary or turning four-way cock to straight air, but we will let it remain as it is—automatic. Now we will apply brakes by reducing through engineer's valve, say twenty-five pounds. This will allow air to equalize from tender auxiliary to brake cylinder, through extra pipe to left auxiliary and release driver-brakes and set tender brake. Now turn four-way cock of left auxiliary to straight air, and release brake by re-charging train line pipe from reservoir. Now all the brakes are released. This is the only way the brake can be used with this extra pipe connected, the driver straight air and tender automatic. This I would not advise to be done, as you have the three brake cylinders and extra pipe to fill from one auxiliary, as the left one is cut off. With eighty pounds initial pressure you would not have over thirty pounds on each piston.

This pipe was meant for a release pipe, connected, as it is, with brake cylinder and running along tender to gangway, with stop-cocks in the end, to be reached while train is in motion. So, should triple valve refuse to act promptly, let the air out of brake cylinder through this pipe—about a ½-pipe. If your triple valve is in good order and kept so there is no use of this pipe, as it is very seldom used, although most engines equipped with air have them. Take the pipe off and plug up the hole. Can't see where it will be of advantage by connecting it at *C* as suggested by you. I don't understand why he says "driver-brake" should receive air from tender auxiliary only in case of emergency. The suggestion to put stop-cock in pipe at "*C*" is where it should be, as then you have auxiliary charged for drivers without bothering with stop-cock.

In regard to excess pressure on engineer's valve there may be several reasons for it. The valve may be stuck or the tension in spring may be too light, or rotary valve may leak—"they are apt to warp," or the gauge may be wrong. Reduce pressure and then re-charge train-pipe by putting handle of valve on feed where it is to be carried while running. If valve and spring is O. K. it will make a singing noise by spring vibrating. The excess valve may be put in wrong. The spring should be enclosed out of sight.

BILLY WILSON.
Clinton, Iowa.

W. H. Thomas, Sup't M. P. of the East Tennessee, Virginia & Georgia system, has taken hold of the circulation of THE LOCOMOTIVE ENGINEER on his system, and has interested most of the officers and men in his department. He writes us that he intends to again make it the banner system in THE LOCOMOTIVE ENGINEER'S circulation, as it was the first year. In 1889, the Michigan Central and the Canadian Pacific got away with them in point of circulation.

W. G. Allen, chief of Div. 207, B. of L. E., Atlanta, Ga., dropped dead on his engine on the Georgia Pacific, on the 12th of December.

LOCOMOTIVE ENGINEER.
DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS.

Economy in the Use of Oil.

The man who uses the least oil on a locomotive is not always the most economical. Between the journal and the bearing there must always be more or less friction; this can be more or less reduced by introducing between the moving surfaces some unguent that prevents in a measure the bearing parts from coming in actual contact, or the molecules from interlocking with each other and allows the load to ride more or less upon the film of oil.

This film of oil will be governed greatly by the pressure there may be between the bearings, the speed at which the journal runs, and its temperature. It is never desirable to be so economical (?) of oil as to take from the bearing so much oil that there will not be at all times as much in position to be used as the revolving journal can possibly draw in between it and the bearing. Every bit of lubricant that is used there reduces the resistance and allows more work to be done, with the expenditure of a given power.

True economy in the use of lubricating oils is in so using it that all, as near as possible, shall be used on the bearing and none *around* it. Locomotive engineers are practicing false economy when they try to run light on oil by not putting enough on, and they are practicing economy in the use of oil when they keep the bearings flooded in it—providing they take pains to keep it from getting away.

It is well-nigh impossible to oil a locomotive in a hurry and not use some oil around the holes, but this should be as carefully done as is possible, and the easiest way to do that is to have your feeders and box packing so arranged that it can be depended upon to feed reasonably well and require little or no oiling on the road. When a man has time to oil deliberately before he starts out, is the time to be careful.

When the packing in a driving-box will keep oil-soaked waste up against a journal, all that is necessary is to see that the waste does not get dry—not to pour oil on the box till it runs all over the box, wheel, frame and township. All the oil that you see around the collar of a pin is doing hurt, not good—it catches dirt and grit.

It is good practice to oil all spring bearings once a week or so, a drop on each hanger and equalizer pin and on the expansion hangers will cause the engine to ride easier and adjust herself to uneven track better.

Oil, if kept clean, can be used over many times, so do all you can to keep dirt out of your cellars and packed boxes, the cup-fed oil can only be used once, as there is no way to get it back to the cup after once being used, but you will be surprised to see how little oil a pin needs if it gets it regularly. Heavy oil wears best on such work, but it is a question if the lighter mineral oils are not better, or at least cheaper, as more can be used and less dependence placed upon its staying on the bearing.

To look at many of our engines on a cold morning, one would think that they had been oiled with a sprinkling pot, and the oil in sight is wasted oil, and what runs the amount up so high; but every drop of oil that has passed between the bearings has done good and its use was economical—provided it was used as much as it could be.

Use as much oil as you possibly can on the bearings of your engine, and as little as you possibly can on the frame, rods, outside of guides and on the ends of the ties.

Some people think that there is a certain fixed quantity of oil that a bearing should have; we believe that for locomotive practice this quantity is all the bearing can carry between the moving parts by being at some part of each revolution in free contact with oil, and on a locomotive this is always possible.

A Wrong Idea.

Every time we find a man that knows something about a certain thing; say he is a machinist with a wide experience on running repairs, or an engineer who has had experience on everything from hook motions right down to date, and want him to write up some of the stories, descriptions of tools, or kinks, or accounts of breakdowns; they all say that they can't.

Perhaps they have just told all about a thing, but say: "Oh, I couldn't write anything on it. I'm only a machinist, or an engineer; it wouldn't do for me to express it on paper as I do to you."

Now that is just what would do the very best, there is now, and always has been, a dearth of railroad and mechanical writers from the ranks of railroad men and mechanics.

Don't be afraid you will fail; try. The mechanics of the country are hungry to hear from you.

A Good Railroad Map.

The Official Railway Guide furnishes this year a large revised railroad map of the United States. As the Official Guide has no particular interest in distorting the features, and changing the boundaries of States to make this or that line the "shortest by four hours," we feel sure, when looking at it, that the State of Ohio in no place reaches as far west as Chicago, and that Pennsylvania is in no place four times as long as New York.

A Timely Suggestion.

The regular slaughter of railroad men has at last attracted the attention of no less a person than the President of the United States, and in his recent message to Congress he makes the following statement.

The attention of the Interstate Commerce Commission has been called to the urgent need of congressional legislation for the better protection of the lives and limbs of those engaged in operating the great interstate freight lines of the country, and especially of the yardmen and brakemen. A petition, signed by nearly ten thousand railway brakemen, was presented to the commission, asking that steps might be taken to bring about the use of automatic brakes and couplers on freight cars. At a meeting of State railroad commissioners and their accredited representatives, held at Washington in March last, upon the invitation of the Interstate Commerce Commission, a resolution was unanimously adopted urging the commission "to consider what can be done to prevent the loss of life and limb in coupling and uncoupling freight cars and in handling the brakes of such cars." During the year ending June 30, 1888, over 2,000 railroad employes were killed in the service and more than 20,000 were injured. It is competent, I think, for Congress to require uniformity in construction of cars used in interstate commerce and the use of improved safety appliances upon such trains. Time will be necessary to make the needed changes, but an earnest and intelligent beginning should be made at once. It is a reproach to our civilization that any class of American workmen should, in the pursuit of a necessary and useful vocation, be subjected to a peril of life and limb as great as that of a soldier in time of war.

It is more than time something was done, and Mr. Harrison has not put the case any too strong. Automatic couplers must come, and then the block system must come. These modern appliances cost money, and it is cheaper, at the present price that human lives are held at, to pay for the wrecks. Human life ought to be held higher.

Some official of the Erie road recently went outside of his legitimate business and interfered with that of the Creator, in trying to make the Erie "employes" honest by posting an order that all must pay their debts promptly. A road that has been stolen back and forth bodily two or three times, and never really knew how big its debt was, is hardly the sort of an oculist to pick specks of debt out of the eyes of its employes. But such orders should not be charged against the road, nor do they represent the brains of a road. Every scientific official that is *born* for the place and gets no practical training for it, has to slop over in some way—we used to work for one who imagined he was Joshua, and thought that the sun and moon would stand still if he said so, and sealed the order with his rubber stamp. But they never did.

We cannot undertake to thank all the lodges of engineers and firemen in the country, who have sent us "comps" to their annual balls and banquets—we haven't room for the directory it would make. Thanks, gents, one and all; sorry we can't reach you all; we're slow freight on the dance, but lightning express on the eat.

ASKED & ANSWERED

(1) Student, Meadville, Pa., asks.

What would be the results, as far as operating railroads, if there were no such thing as friction? *A.*—There would be no railroads. Without friction nothing could exist on the earth in its present shape. When friction is eliminated chaos will commence.

(2) C. S. Aldrich, Pascoag, R. I., asks:

Will you please tell me, in seconds, how long it will take a passenger train, going at the rate of forty miles per hour, on a down grade of forty-five feet, to stop with air brakes; and also the distance in feet, using Smith's vacuum brake? *A.*—Your question could not be answered with anything approaching correctness without knowing the entire weight of engine and train, and the weight of the braked portion of the train. Without this data all answers would be simply guesses.

(3) Janesville, Wis., asks.

Are there any reliable rules about the size, weight and depth of locomotive driving springs? I want to know about what proportion of the total carrying capacity of the springs can be safely used. *A.*—Driving springs are usually made so that when loaded there will be as much set in the springs (usually from 2" to 2¼") as to just let them come straight when the driving-box is thrown to its highest possible position. No better rules for determining the size, weight or number of leaves have been found than those of D. K. Clark (1855). In the chapters on running gear in Forney's Catechism of the Locomotive, these rules are given and well explained. We know of no rules in use where the load is determined by the total carrying capacity or breaking strain.

(4) G. A. M., Albany, N. Y., writes:

I am running an engine, and find that her exhaust takes place on one side on the centers, while with the exhaust on the other side one occurs when the pin is on the eighth, the other when it is between the quarter and the back center. Please tell me how I am to make her beat square, as I make the necessary changes myself. *A.*—It would appear from your diagnosis of the case that it was about time that some changes were made. If your eccentrics are keyed on, and are in place, run the valves over; if you are not sure as to the proper methods, see page 2 of THE LOCOMOTIVE ENGINEER of August, 1888. If the eccentrics are slipped you can get them back by placing the engine on the forward center (for the forward motion eccentric), place the lever in the corner ahead, and pinch the eccentric around on the shaft, in the direction it is to run, until the valve slightly opens the front port; this gives the lead opening; fasten the eccentric and bar the engine over to the back center; if the lead opening is the same for the back port as for the forward one the eccentric blades are of the proper length; if they are not of the same length, run the valves over and get them so.

IN THE ROUNDHOUSE AND Repair Shop.

A Connecticut Railroad Shop.

(Editorial Correspondence.)

Somehow or other the railroad shops of New England are not so easy to write up as those of the West; there are different things to see, but somehow they do not exactly seem the things that you want to describe at length. I started out this month, as usual, to find something of interest for the readers of THE LOCOMOTIVE ENGINEER, and steered in a northerly and easterly direction, more because it was just about opposite to the direction of my last tramp than for any other reason. A train of the New York, New Haven & Hartford Railroad was standing at the Grand Central depot, and I stepped aboard.

The first thing I do nowadays on boarding a railroad train is to

CONCEAL MY IDENTITY

by putting my hard-boiled hat in the rack, and getting on one of those little good-for-nothing skull-caps, then I conceal my Brotherhood pin in the lining of my vest, and commence to ask the train men such questions as, "When the 11 o'clock train goes?" so as to effectually throw them off the scent, if they might have thought I was a railroad man—not that I am ashamed of the crowd or the occupation, but it hurts my proud spirit to claim to be a railroader, and yet have in my possession a real, made-a-purpose ticket. In the past I confess to being instrumental in the free transportation of a large quantity of railroad meat, and try as I may to be independent and pay my fare, it seems as though I ought to ride free to get even. I don't think I shall ever get over this feeling—perhaps I rode free too long.

The first thing of interest was a hat-rack that was actually made to hold things; this is a brass frame about two feet wide, the bottom of which is composed of a coarse web of brass wire; there is no attempt to make sides to it; the whole thing is inclined toward the outside, and it runs from end to end of the car. The largest valise can be held there securely, it will take in umbrellas, fish poles, or anything else likely to get in at the door. Where such a device is provided, there ought to be a heavy penalty for the swine that wants a seat for his grips, one for his feet and another for himself.

ENCOURAGING DRINKING.

A few miles out of the city, some one touched my arm, and asked me to "have a drink?" and a colored man held a silver-mounted tea-kettle, with a beer-glass receptacle in front of it, invitingly in my face—nothing but ice water—but it was pretty good, and I thought it must be a pretty nice thing for women with children, or aged or ill people, it might also keep from suffering, the man who is always afraid some one will get his seat, if he risks getting a drink of water. I am told that the passing of water on all passenger trains in the State of Connecticut is required by the laws, and was enacted for the benefit of the soldiers, during the late unpleasantness.

THE NEW HAVEN SHOP.

I don't know how big the New Haven shops are, and I don't think there is a reader of the paper that cares to know; they are built of brick, are old enough to vote, without a doubt; there is nowhere an attempt at ornamentation—they are business all the way through.

The roundhouse is a complete circle, and the office and the main shop are located back of it, so that in going to them you have to go through the roundhouse or around it.

HANDLING THE COAL.

The coal used here is of two qualities, the best being the famous Pocahontas, the other being a fine, dirty coal from Pennsylvania, that the men have named "Philadelphia mud." This coal is brought here in vessels, and these tie up to the coal-bin at the shop, the latter being right on the shore. The coal is hoisted out of the schooners in a special bucket, and is elevated by steam to a track running out over the coal chute; here the coal is dumped into a car on this track, and after that it takes care of itself—the track being inclined, the loaded car runs down the track by gravity, in doing so it winds up a weight attached to a cable on the upper end of the car; at the end of the track the car strikes a trip that dumps it, and then the weight, being heavier than the empty car, returns it to the upper end of the track for another load. Pocahontas or Virginia coal is good, and the engines do well with it, but the other coal is rather poor stuff. They tell a story there on one of the engineers. He went by the coal dock on his way home, and seeing the captain of a schooner, whom he knew, just tieing up, asked him if he had a load of Pocahontas. "No, Philadelphia mud," was the reply. "I wish to thunder, you had sunk in the Sound," was the cheerful retort. This reminded me of the story of the old Scotch dominie, in the days when dominies lived on faith and donations, one brother donated a load of green poplar wood, and was surprised the next Sunday morning to hear the good dominie pray that brother so and so be prevailed upon to cut some of that wood, and donate it to the use of Satan, as he, the dominie, was sure that about four cords of it would put out the fires of sheol.

AGE AND SIZE.

The present New Haven road is a consolidation of several smaller roads, most of which were started or built well back into the 40's. The line is known locally as the Consolidated Road, it operates 863.65 miles of road, including sidings, and has in use over 200 locomotives. Most of the divisions are short, and the men do considerable dodging around for a day, but make big money for an eastern road. One feature not usually seen is the

WEEKLY PAY CAR.

Another law in the "Nutmeg State," all corporations have to pay their men weekly. This road, short as it is, keeps two pay cars in service. The engines are backed into the roundhouse, which is a low-roofed one, with an open center. There are no improved methods specially worthy of imitation in this roundhouse; it is a fair sample of a house on a busy road, not as good as the best, and far from being the worst.

THE ENGINES

would be noticed anywhere; the majority of them were built by the road, and are peculiar to it. While they have a few Moguls and 10 wheelers for freight that have come to them as prizes with the little roads that they have got hold of, the great majority are 8-wheelers, straight stack and extension fronts. They are a nicely modeled engine, and do good work, ride well and steam fair. The first thing remarked by the observing engineman is that there are

NO RUNNING BOARDS.

The board ends at the wagon top, just ahead of the cab, this makes the cleaning of the lower part of the boiler easier, and provisions are made for agile firemen to get around over the upper works—we observed several standing on the copper injector pipes. The guide yokes do not reach across the frame, but are strongly braced to the side of boiler, all have an expansion hanger just ahead of forward driving-box. A great many of these engines have underhung links, something not usually seen now.

A DUST PREVENTER.

The extensions are lagged and covered by jacket; the front cinder slide is the common one of a piece of flat iron in a slot across the pipe, with coal-pick marks on the slide, to tell how it is opened. They have one good thing about them, and that is a hole in the front of the cinder pipe into which a stream of water is introduced when sparking engines at division terminals, this is a simple safeguard against clouds of dust.

WATER TABLES

are used in most of the fire boxes, though there are some brick arches; and movable diaphragms operated from the cab. The bands on the jackets are Russia iron, but are made to look better and stronger by a row of neat, round-headed brass rivets in the center. The cylinder castings have a single admission port into the chest, this is at the back, or cab, side of the other ports.

The Bristol

ROLLER VALVE

is used, this is a plain slide valve riding at each end on a series of steel rollers running in a frame on a track at each end of the ports. The success of this device depends so much upon the nicety of the fits that it is very difficult to keep the valves tight—one man will be kicking about his valves blowing on a new engine, and the next one will swear he has run two years without a simmer. The main trouble with the device seems to lie with the tracks—the least wear or displacement of the track lifts the valve off the seat or drops it down on the seat, and takes the load off the rollers, either of which defeats the objects of the invention.

THE LINK BLOCKS

have no sides, but are held in the link by ribs on the die block that fits into slots in the center of each link face. I fail to see any advantage in this plan, but perhaps it has some; probably it is retained to prevent making changes. On most of the 8-wheelers the forward tire has no flange; this, it is claimed, enables the engines to go around the heavy curves into Springfield—the engines all have rigid trucks—there are Y's on the road where these engines are not allowed to go, because of the bald tire—curious thing it don't work both ways. Iron pilots are used.

CAB LAMPS

are hung from the roof of the cab, and seem to make a neat, cool and handy arrangement. The gauge-cocks are of that class we used to call "automatic" in the West—leak so bad, as a usual thing, that it is unnecessary to open them. I never saw a babbitt seated valve I would trust at all to keep tight. There are no automatic cylinder lubricators used, and there is no limit to the oil a man may use. A bulletin is posted monthly, but no credit is given for the best records on coal or oil. I noticed that some of the men ran only two miles to a pint of engine oil, some—principally construction engines—ran 19 to 21 miles for a pint, while the average is but six or seven miles. The engines are kept clean and show good care. This road at one time owned the finest painted engine in America, gold leaf and oil paintings were everywhere, and some of the scenery painted on the tenders was worth lots of money; this has all gone now, and while the engines are neat, there is nothing of the circus poster about them.

There are men to

CLEAN FLUES

and spark the engines, and the firemen are not required to polish the bright work on the cylinder heads and chests, most of which are polished iron. In cleaning flues they have a little device worth imitating, a piece of air hose with a coupling head is coupled to the front end air hose, and by using a piece of pipe on the other end, each flue is blown out thoroughly, if a flue is stopped up solid, an auger is used to loosen the cinders, then the air-jet does the removing.

NEW ENGINES.

There are six very large Baldwin 8-wheelers here on freight, they are very heavy, and have a cylinder 20x22; it is claimed that they are so heavy they break rails, their short stroke does not help them out for freight service. The Sellers restarting injectors used on these engines were originally placed close to the roof of the cab, some forty inches above the top of tender; these have all been lowered to a line with the top of the seat box, the air pump has also been placed below the cab and between the drivers.

Some new 8-wheelers just sent here were built at the R. I. Locomotive Works, at Providence, and are the standard engine of the road exactly, they have 54,000 pounds on their drivers, and cylinders 18x24, and are the engines that were to expand steam more on account of the light weight—a feat promised by one of our railroad papers.

Back of the roundhouse there is a store-house and the offices in one building, and another building where all the wheel work is done. Here are located the big wheel lathes, the presses, etc., in fact, all the wheel and axle machinery. We noticed on a pair of wheels having the tires turned, that the tire was set on blocks of hard wood arranged around the wheel center, a plan originally used by Mr. Griggs, Sr., one of the oldest master mechanics in the New England States.

NEAT TOOLS.

All the machine tools are painted a wine color and striped with red, and are kept clean and neat, we noticed no ancient tools, and the back shop presents a busy appearance, there being several engines getting general overhaulings.

FRATERNAL FEELING.

There appears to be no red tape between the men and the officials, all being approachable. We found a couple of young men hustling around the roundhouse taking subscriptions for THE LOCOMOTIVE ENGINEER, and Master Mechanic Henney advised all the men to take the paper—said it was in the right line.

The Fireman's Brotherhood lodge at this point, having over a hundred members, have recently inaugurated the locomotive discussion movement and there is a great interest taken. They took Mr Cushing's questions in THE LOCOMOTIVE ENGINEER, and discussed every one of them, from preface to finis, and called my attention to the fact that the large club recently sent in all commenced with the papers containing these questions.

This party of progressive young men are going to take up the discussion of the train rules of their own road, and then a general line of mechanics. To show with what interest such things are watched by officials, I have but to mention that Master Mechanic Henney is having a valve motion model built for this lodge, and General Superintendent Shepard has asked to address the club, and help them in any way in his power.

AVERAGES WELL.

Taking it all around, the New Haven shops are above the average of eastern shops, the engines are good, and the men are intelligent. If I was going to offer any suggestion at all, I would want the inverted dish-pan taken off of the top of those straight stacks—it is far from pretty.

J. A. H.

Fig. 1.

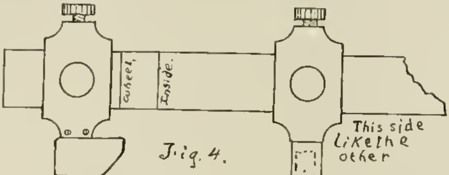


Fig. 4.

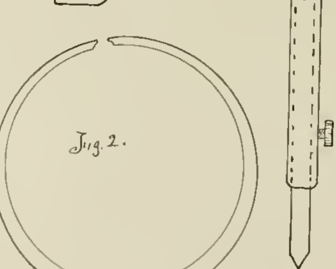


Fig. 2.

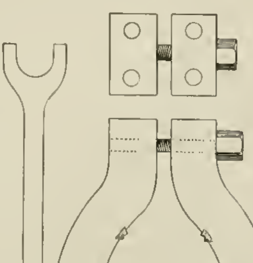


FIG 3

The Schenectady Locomotive Works have completed a compound locomotive for the Michigan Central. It is built on the Mallett system, with an automatic equalizing valve between the high and low pressure cylinder, something like the valve of the Worsdale-Van Borries system.

A Rhode Island Railroad Shop.

One of the neatest little shops that it has been our good fortune to visit, is the shops at Valley Falls, in the suburbs of Providence, of the Providence & Worcester road—now a part of the N. Y., P. & B. system. The old P. & W. road had fifty miles of track, and used thirty eight locomotives, doing a large passenger business—especially suburban business.

The shops at Valley Falls were built five or six years ago, and, for the size of the plant, are as elaborate as the best. The buildings are neat, part of wood, the rest of brick, but all complete, painted and in repair, no old sheds or eyesores anywhere.

The paint shop, drawing office, store-room and master mechanic's office are separated from the main shop by a steam-actuated transfer table.

In the main shop there are three stalls, and the machinery is located at the opposite end of the shop. The machine tools are about the same age as the shop. There seems to be a sample tool from most of the first-class makers. All the lathes have different tapers for their centers, and are in every other way about as different as they well can be.

The heavier tools are covered by cranes, and facilities are had for handling easily all heavy work. All the tools are clean and well kept, and every wrench, chuck and gear has its place.

Just off the main shop is the tool-room—probably 14x30—the most interesting part of the shops. There are here a small engine lathe, a milling machine, twist drill grinder, etc. Along one end of the room there is a cabinet of drawers, in which fine test gauges, taps, dies, and such work as is used to measure cutting tools, are kept. On the side next the street is a bench the entire length of the shop; at the other end a stairway leading to the stock-room above, and on the other side, next the shop, a series of inclined shelves about 18" wide and extending from the floor some ten feet high.

The manner of classifying the tools is different from the plan used in any other tool-room we ever visited.

All the special tools intended for work on any certain part of a locomotive are assembled together, regardless of what they are. For instance, here is a section of a shelf a couple of feet long, on which is painted "Crosshead tools." There are the gauges as to size, drills to drill holes, reamers to follow the drills, and taps to follow the reamers if needs be; there will be a taper plug gauge to fit the piston rod hole to, and all jigs used in making and repairing crossheads.

Every tool is branded, in plain letters, its use, and it would seem that mistakes caused by men using the wrong sized tools could not occur.

The plan for caring for crosshead tools is followed with all other parts, such as valves, pistons, boxes, etc. Some of the kinks and short-cuts are extremely ingenious, and the readers of THE LOCOMOTIVE ENGINEER have by no means heard the last of them at the end of this article.

Wm. Foster, who has charge of this department, is a well-known "kink" man to our readers, and he has an able assistant in Frank Pond.

For putting studs into boilers, cylinders or other work, they have a series of forcing nuts—simply nuts in which the hole does not go through. These are double, having a different size or different thread at each end. The thread is made a loose fit on the studs, and the end of the stud is allowed to "bottom" on a copper disk in the center of the nut. These are very handy, as any stud can be put in with a common wrench without marring the stud, as is the case with the use of pipe wrenches.

For removing studs they use a very ingenious tool, as shown in Fig. 1. This is a long nut having a swinging disk of steel with a milled edge, that engages with the side of the stud and binds. It has a wide range for sizes that it will hold, can be used right or left, and ought to be a popular tool. It was invented by John Bowman, a mechanic in the Altoona shops of the P. R. R.

Great care is taken here to keep the trucks square, and there are in use many gauges for wheel and axle use that our friend Foster will no doubt let us know about. They mark all axles on the center, exactly between the centers of the bearings, and use a gauge like Fig. 4 to find out if the wheels are in their proper places

Some makers shove the wheels upon the axles to a shoulder or to a gauge measuring only from one flange to the other, and it often happens that the wheels are not the same distance each from the center of the journal, and a "slewed" truck is the result, but by measuring from the center to each flange, and also to the inside of wheel flange, it can be seen at once whether or no the wheels are right upon the axles. This gauge has two wheel tread gauges and one center pointer; this is so arranged as to be lengthened or shortened to meet the requirements of service for all sized wheels.

It may be well for us to explain right here that these cuts are from pencil sketches from memory, and are not intended as specifications to build to, but to show how results are accomplished.

Crossheads where the main-rod pin is cast solid, generally require quite an elaborate machine to turn them up. Mr. Foster has a clamp made in the shape of Fig. 3, that does this work very nicely. Each side carries five steel cutters, each cutter having two teeth; the clamp is forced against the pin by the top bolts, and the whole device turned by using the wrench shown by inserting its forked end in holes drilled into the end of the clamps, as shown. This device does good and true work in a short time, and can be used on a crosshead without taking it off the guides

Above the tool-room there is kept a large stock of repairs, mostly finished parts—valves, packing, brass work, etc. We noticed that the packing rings used were heavier at the bottom, as in Fig. 2. These last as long as the engine stays out, as a usual thing. They are turned considerably larger than the cylinder, a piece cut out, and the ring sprung together and turned up in the shape shown.

The interior of this shop is finished in hard pine, and the interior of the offices and tool-room is finished in oil. Such tools as boring bars, valve seat planers, etc., have a cabinet of their own, where they are kept out of the dirt and dust.

An overhead system of steam heating was put into this plant, but in the shops, especially the car shop, where the roof was high, it failed to keep the men comfortable while making the pitch fry on the roof, and has been put below the benches.

Albert Griggs is master mechanic here, Russell Hawks general foreman, and Wm. Foster master of tools and kinks.

The engines are of several classes, mostly eight-wheelers, some Forneys being used on suburban work.

They have good water, and little trouble with flues or fire-boxes leaking.

We found here, as on most New England roads, that brass pipe is used for most of the work—feed pipes and branch pipes; it does not rust, looks better, and is easier kept clean than copper, and will "let go" when you try to take it down.

Elementary Lessons in First Principles.

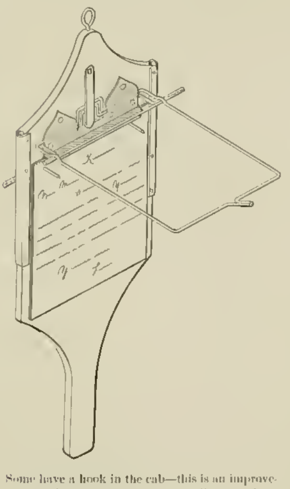
FOURTH LESSON.

In England it is customary to connect the eccentric blades to the ends of the link instead of back of the slot, and to hang the link from one of these pins, sometimes the top and as often the bottom. In this case the angularity of the rod is partially compensated for by placing the upper end of the hanger "out"; when this is done it is necessary to place it farther out than when the lower end is hung out of the center line; it may not be out of place here to remark that the "limp" is the first thing an American engineer notices on English engines. On some classes of engines the eccentrics are located on an axle, other than the main axle, and ahead of it, like the elevated engines in New York and Brooklyn, when this is done it is necessary to put up the motion so that the link will be *up* when the engine is running ahead. If the link is down when the engine is running ahead, the lead will *decrease* as the link is worked nearer the center, whereas it ought to increase; this is explained when we learn that, to increase the lead on an ordinary link engine, we would *advance* the eccentric on the shaft *in the direction in which it is to run*. So, when we hook up the link on an ordinary link motion engine, we do not move the eccentric on the shaft; but we do move the entire motion *back* on the eccentrics, which amounts to the same thing.

In the class of locomotives mentioned, if the link was down when the engine was in forward gear, when we raised the link we should move the entire motion *ahead* on the eccentrics, and in the direction in which they will run, instead of back, which would delay all the functions of the valve—opening, cut-off, and compression, and decrease the lead.

A Handy Order-File for the Cab.

On this page will be found an illustration of one of those handy little things that most railroad men appreciate. Every man who has ever run an engine knows that the matter of keeping the train orders received in service is not attended to with the care its importance deserves; nine runners out of ten simply read them, crimp them up and put them in the first pocket they can reach; if it is necessary to consult them a second time, they have to sort over a miscellaneous collection of old orders of uncertain age, and select the last one; this style of order hook is the one that prevents the fireman from seeing them also.



Some have a hook in the cab—this is an improvement, but do the best we can, they will get too dirty to read, are liable to blow away or get too much wear to be legible.

The little device shown herewith is the invention of Mr. H. C. Cunningham, of Topeka, Kan. Its construction is so plain that any one can understand it; the board body has a wire frame on each side, that is held against it, and keeps the orders stretched out and on the file in the order received, and by using both sides two orders can be consulted without lifting the wire holder. Thus the points can be filled with orders before any are lost, and disputes that come up can be settled by referring to the file, but the adaptability of the device to locomotives lies in the frame and the handle; the runner can find his order with his gloves on, it is all stretched out ready to read, and he can take it by the handle and hold it up to the cab light or in the glare from the fire-door, and read it while the engine is in motion. There are loops of metal on each side that stiffen the whole device and serve to hold pencils or a stylus. It can be hung up or carried in the seat-box, costs but a few cents, and will save orders, finger marks and delays.

An Engineer's Christmas Story.

BY JOHN ALEXANDER.

Mr. Editor, there has no right fresh pointers come to the top of my mental soup-kettle of late, so I have not skimmed one off for you, but I was just paying my month's salary over to Mrs. A., to get me a Christmas present with, and it brought up to my mind a Christmas story of another engineer, and I thought I would tell it to the boys—with your permit. It is not so very much mechanical—neither is the other stuff I write to you.

In the summer, fall and early winter of 1863, I was tossing chips into an old Hinckley insider up in New England, for an engineer by the name of James Dillon. Dillon was considered as good a man as there was on the road, careful, yet fearless, kind-hearted, yet impulsive, and a man whose friends would fight for him, and whose enemies hated him right royally.

Dillon took a great notion to me, and I loved him as a father; fact of the matter was, he was more a father to me than I had at home, for my father refused to be comforted when I took to railroading, and I could not see him more than two or three times a year at the most, so when I wanted advice I went to Jim

I was a young fellow then, and, being without a home at either end of the run, was liable to drop into pitfalls. Dillon saw this long before I did. Before I had been with him three months, he told me one day coming in that it was against his principles to teach locomotive running to a young man who was liable to turn out a drunkard or a gambler, and disgrace the profession, and told me I had better pack up my duds and come up to his house, and let "mother" take care of me—and I went

I was not a guest there; I paid my room-rent and board just as I should have done anywhere else, but I had all the comforts of a home, and enjoyed a thousand advantages that money could not buy. I told Mrs. Dillon all my troubles, and found kindly sympathy and advice, she encouraged me in all my ambitions, mended my shirts, and went with me when I bought my clothes. Inside of a month I felt like one of the family, called Mrs. Dillon "mother," and blessed my lucky stars that I had found them.

Dillon had run a good many years, and was heartily tired of it, and seldom passed a nice farm but he would call my attention to it, often saying,

"Jack, now there's comfort; you just wait a couple of years, I've got my eye on the slickest little place, just on the edge of M——, that I am saving up my pile to. I'll give you the Roger William one of these days, Jack, say good evening to grief, and me and mother will take comfort. Think of sleeping till eight o'clock, and no poor steamers, Jack, no poor steamers." And he would reach over and give my head a gentle "duck," as I tried to pitch a curve to a front corner with a knot. Those Hinckleys were powerful on cold water.

At Dillon's home there was a "system" of financial management. He always gave his wife just half what he earned, took ten dollars for his own expenses during the month, out of which he clothed himself, and put the remainder in the bank. That was before the days of very high wages, so that, even with this frugal management, the bank account did not grow surprisingly.

They owned their own home, and out of her half "mother" had to pay all the household expenses and taxes, clothe herself and two children, and send them to school. The oldest, a girl of some sixteen years, was away to normal school, the boy, about thirteen or fourteen, was at home, going to public school, and wearing out more clothes than all the rest of the family.

Dillon told me that they had agreed on the financial plan used in the family before their marriage, and often used to say to me that for the life of him he did not see how "mother" got along so well on the allowance.

When he drew a small month's pay he would say to me, as we walked home:

"No cream in the coffee this month, Jack." If it was unusually large, he would say "Plumb duff and fried chicken for a Sunday dinner."

He insisted he could notice the rate of pay in the eatables, but there was none—it was his kind of fun, "Mother" and I were fast friends; she became my banker, and when I wanted an extra dollar I had to ask her for it, and tell what I wanted it for, and all that. Along late in November, Jim had to make an extra one night on another engine, which left me alone at home with "mother" and the boy—I had never seen the girl—and after swearing me to be both deaf, dumb and blind, "mother" took me into a *secret*.

For ten years she had been saving money out of her allowance, until the amount now reached nearly $2,000. She knew of Jim's life ambition to own a farm, and she had the matter in hand if I would help her. Of course I was head over heels in the scheme at once.

She wanted to buy the farm near M——, and give Jim the deed for a Christmas present—and Jim mustn't even suspect.

Jim never did.

The next trip I had to buy some underclothes—would "mother" tell me how to pick out pure wool? Why, bless your heart, no, she wouldn't, but she'd just put on her things and go down with me.

Jim smoked and read at home.

We went straight to the bank where Jim kept his money, asked for the president, and let him into the whole plan. Would he take $2,100 of Jim's money, unbeknown to Jim, and pay the rest of the amount above what "mother" had?

No, he would not, but he would advance the money for the purpose—have the deeds sent to him, and he would pay the price—that was fixed.

Then I hatched up an excuse, and changed off with the fireman on the M—— branch, and spent the best part of two lay-overs fixing up things with the owner, and holding back the records of the deeds till after Christmas.

But every evening there was some part of the scheme to be talked over, and "mother" and I held many whispered conversations. Once Jim, smiling, observed that, if I had any hair on my face, he would be jealous.

I remember it was on the fourteenth day of December, 1863, that pay day came. I banked my money with "mother," and Jim, as usual, counted out his half to that dear old financier.

"Uncle Sam 'd better put that un in the hospital," observes Jim, as he comes to a ragged bill.

"Goddess of Liberty pretty near got her throat cut there, guess some reb. has had hold of her," said Jim, as he held up a ten dollar bill, then laying it down, he took out his pocket book and cut off a little three-cornered strip of pink court plaster, and made repairs on the bill.

"Mother" pocketed her money greedily, and before an hour I had that very bill in my pocket to pay the recording fees in the court house at M——.

The next day Jim wanted to use more money than he had in his pocket, and asked me to lend him a dollar. As I opened my wallet to oblige him, that patched bill showed up. Jim put his finger on it, then turning me around toward him, said:

"How in the h——l came you by that?"

I turned red—I know I did—but I said, cool enough, "'mother' gave it to me in change."

"That's a lie," he said, and turned away.

The next day we were more than two thirds of the way home before he spoke, then, as I straightened up after a fire, he said:

"John Alexander, when we get in you go to Aleck (the foreman), and get changed to some other engine." There was a queer look on his face; it was not anger, it was not sorrow—it was more like pain.

I looked the man straight in the eye, and said:

"All right, Jim, it shall be as you say; but, so help me God, I don't know what for. If you will tell me what I have done that is wrong, I will not make the same mistake with the next man I fire for."

He looked away from me, reached over and started the pump, and said:

"Don't you know?"

"No, sir, I have not the slightest idea."

"Then you stay, and I'll change," said he, with a determined look, leaned out of the window, and said no more all the way in.

I did not go home that day; I cleaned the Roger William from the top of that mountain of sheet-iron known as a wood-burner stack to the back casting on the tank, and tried to think what I had done wrong or not done at all, to incur such displeasure from Dillon. He was in bed when I went to the house that evening, and I did not see him until breakfast. He was in his usual spirits there, but on the way to the station and all day long he did not speak to me.

He noticed the extra cleaning, and carefully avoided tarnishing any of the cab fittings, but that awful quiet, I could hardly bear it, and was half sick at the trouble, the cause of which I could not understand. I thought that if the patched bill had anything to do with it Christmas morning would clear it up.

Our return trip was the night express, leaving the western terminus at 9.30. As usual, that night I got the engine out, oiled, switched out the cars, and took the train to the station, trimmed my signals and headlight, and was all ready for Jim to pull out. 9 o'clock came and no Jim; at 9.10 I sent to his boarding house—he had not been there. He did not come at leaving time—he did not come at all.

At 10 o'clock the conductor sent to the shop for another engineer, and at 10.45 a fireman came in his stead, with orders for John Alexander to run the Roger William until further orders.—I never fired a locomotive again. I went over that road the saddest-hearted man that ever made a maiden trip. I hoped there would be some tidings of him at home—there was none. I can never forget the blow it was to "mother," how she braced up on account of her children; but oh, that sad face. Christmas came, and with it the daughter, and then there were two instead of one—the boy was frantic the first day, and playing marbles the next.

Christmas day there came a letter—it was from Jim. Brief and cold enough, but such a comfort to "mother." It was directed to Mary J. Dillon, and bore the New York post-mark. It read: "Uncle Sam is in need of men, and those who lose with Venus may win with Mars. Enclosed papers you will know best what to do with. Be a mother to the children—you have *three* of them. James Dillon."

He underscored the three—he was a mystery to to me. Poor "mother," she declared that no doubt "poor James' head was affected." The papers with the letter were a will, leaving her all, and a power of attorney allowing her to dispose of or use the money in the bank. Not a line of endearment or love for that faithful heart that lived on love, asked only for love, and cared for little else.

That Christmas was a day of fasting and prayer with us.

Many letters did we send, many advertisements were printed, but we never got a word from Jas. Dillon, and Uncle Sam's army was too big to hunt in. We were a changed family, quieter and tender of one another's feelings, but changed.

In the fall of '64 they changed the runs around, and I was booked to run into M——. Ed, the boy, was firing for me. There was no reason why "mother" should stay in Boston, and we moved out onto the little farm. That daughter, who was a second "mother" all over, used to come down to meet us at the station with the horse, and I talked sweet to her, you bet.

Along in May, '65, "mother" got a package from Washington; it contained a tin-type of herself, a card with a hole in it, evidently having been forced over a button, on which was her name and the old address in town, then there was a ring and a saber; on the blade of the saber was etched "Presented to Lieutenant Jas. Dillon, for bravery on the field of battle." In the bottom a note in a strange hand, simply saying:

"Found on the body of Lieut. Dillon after the battle of Five Forks."

Poor "mother," her heart was wrung again, and again the scalding tears fell. She never told her suffering, and no one ever knew what she bore. Her face was a little sadder and sweeter, her hair a little whiter, that's all.

I am not a bit superstitious, don't believe in signs or presentiments, or pre-nothing, but when I went to get my pay on the fourteenth day of December, 1866, it gave me a little start to find that bill with the chromo of the Goddess of Liberty with the little three-cornered court-plaster on her windpipe, and I got rid of it at once, and said nothing to "mother" about it, but I kept thinking about it and seeing it all the next day and night.

On the night of the seventeenth I was oiling around my Black Mariar to take out the local, leaving our western terminus just after dark, when a tall, slim old gentleman stepped up to me and asked if I was the engineer—don't suppose I looked like a president.

I confessed, and held my torch up so I could see his face—a pretty tough looking face. The white mustache was one of those military kind, with reinforcements of whiskers on the right and left flank of the mustache proper. He wore glasses, and one of the lights was ground glass. The right cheek bone was crushed in, and a livid red scar extended across the eye and cheek, the scar looked blue around the red line because of the cold.

"I used to be an engineer before the war," said he. "Do you go to Boston?"

"No, to M——."

"M——! I thought that was on a branch?"

"It is, but is now an important manufacturing point, with regular trains from there to each end of the main line."

"When can I get to Boston?"

"Not till Monday, now, we run no through Sunday trains. You can go to M—— with me to-night, and catch a local to Boston in the morning."

He thought a minute, then said: "Well, yes, guess I had better. How is it for a ride?"

"Good; just tell the conductor I told you to get on."

"Thanks, that's clever. I used to know a soldier who used to run up in this country," said the stranger, musing—"Dillon, that's it, Dillon."

"I knew him well," said I; "I want to hear about him."

"Queer man," said he, and I noticed he was eyeing me pretty sharp.

"A good engineer."

"Perhaps," said he.

I coaxed the old veteran to ride on the engine—the first coal burner I had had. I wanted to pump him.

He seemed more than glad to comply. Ed was as black as a negro, and swearing about coal burners in general, and this one in particular, and made so much noise with his fire tools after we started, that the old man came over and sat behind me, so as to be able to talk.

The first time I looked around after getting out of the yard I noticed his long slim hand on the top of the reverse lever. Mr. Editor, did you ever notice how it seems to make an ex-engineer feel better and act more satisfied to get his hand on a reverse lever, and feel the life throbs of the mighty giant under him? Why, his hand goes there by instinct—just the same as an ambulance surgeon will feel for the heart of the boy with a broken leg.

I asked the stranger to "give her a whirl," and noticed with what eager joy he took hold of her. I also observed with surprise that he seemed to know all about "four-mile hill," where most new men get stuck. He caught me looking at his face, and, touching the scar, remarked:

"A little love pat, with the compliments of Wade Hampton's men."

We talked on a good many subjects and got pretty well acquainted before we were over the division, but at last seemed talked out.

"Where does Dillon's folks live now?" asked the stranger slowly, after a time.

"M——," said I.

He nearly jumped off the box. "M——? I thought it was Boston."

"Moved to M——."

"What for?"

"Own a farm there."

"Oh, I see; married again?"

"No."

"No!"

"Widow thought too much of Jim for that."

"No!"

"Yes."

"Er—what became of the young man that they—er—adopted?"

"Lives with 'em yet."

"So?"

Just then we struck the suburbs of M———, and, as we passed the cemetery, I pointed to a high shaft, and said:

"Dillon's monument."

"Why, how's that?"

"Killed at Five Forks; widow put up monument."

He shaded his eye with his hand and peered through the moonlight for a minute.

"That's clever," was all he said.

I insisted that he go home with me. Ed. took the Black Maria to the house, and we took the street cars for it to the end of the line, and then walked.

As we cleaned our feet at the door, I said:

"Let me see, I did not hear your name?"

"James," said he. "Mr. James."

I opened the sitting-room door, and ushered the stranger in.

"Well, boys," said "mother," slowly getting up from the fire, and hurriedly taking a few extra stitches in her knitting before laying it down to look at us, "you're early."

She looked up, not ten feet from the stranger, as he took off his slouched hat and brushed back the white hair. In another minute her arms were around his neck, and she was murmuring "James" in his ear, and I, like a dumb fool, wondered who told her his name.

Well, to make a long story short, it was James Dillon himself, and the daughter came in and Ed came, and between the three they like to have smothered the old fellow.

You may think it funny he didn't know me, but don't forget that I had been running for three years—that takes the *fresh* off a fellow—then, when I had the typhoid, my hair laid off, and was never reinstated, and when I got well the whiskers, that had always refused to grow, came on with a rush—and they were red. And again, I had tried to switch with an old hook-motion in the night, and forgot to take out the startin' bar, and she threw it at me, knocking out some teeth, and, taking it altogether, I was a changed man.

"Where's John," said he, finally.

"Here," said I.

"No!"

"Yes."

He took my hand, and said, "John, I left all that was dear to me once, because I was jealous of you, I never knew how you came to have that money, or why, and don't want to. Forgive me."

"That is the first time I ever heard of that," said mother.

"I had it to buy this farm for you—a Christmas present—if you had waited to have got it," said I.

"That is the first time I ever heard of that," said he.

"And you might have been shot," said mother, getting up close.

"I tried my darndest to be, that's why I got promoted so fast."

"Oh, James," and her arms were around his neck again.

"And I sent that saber home myself, never intending to come back."

"Oh, James, how could you?"

"Mother, how can you forgive me?"

"Mother" was still for a moment, looking at the fire in the grate.

"James, it is late in life to apply such tests, but love is like gold, ours will be better now, the dross has been burned away in the fire. I did what I did for love of you, you did what you did for love of me; let us all commence to live again in the old way, just as if there had been no mishap at all," said she, and those arms of hers could not keep away from his neck.

Ed. went out with tears in his eyes, and I beckoned the daughter to follow me. We passed into the parlor, drew the curtain over the archway—and there was nothing but that rag between us and heaven.

And where are they now? Why, probably sitting on that same old sofa, the lovingest old lovers that ever loved.

And where is Ed? Married to the homeliest woman in the State of Massachusetts, and pulling passengers on the main line.

And where is the girl? Mr. Editor, did you notice that there was hummixes in the lines of this copy, and that there were some letters that ought to have tails that were bobtailed, and some that should be tailless that are all tail? You did? Well, it looks as if that might have been caused by the table being *jiggled*, don't it? Well, now, if you had a plan of our kitchen taken at this present moment, you would see a horny-handed son of toil that ought to be in better business, trying to write a Christmas story on one end of a kitchen table, while that daughter irons on the other, and kicks about the size of the air-holes in my socks.

Mr. E. N. Dickinson, one of the best known patent attorneys in the world, died in this city on the 22d of December, in his sixty-fifth year. Mr. Dickinson took up the case of Sickles, the inventor of the cut-off known by his name, and, in the long trials to establish the inventor's rights, became himself a well-posted engineer. Mr. Dickinson was a great advocate of the expansive use of steam at high pressure. He fitted up the steamship "Idaho," and made some trials in competition with other vessels of the day. He had a locomotive built at Cooke's some years ago, that, while using the ordinary link motion, if we remember right, had four valves, one for each admission port and each exhaust. The engine run a short time, and met with an accident that broke her cylinders, and they were never rebuilt. At the time of his death he had a new design of a locomotive well under way, and the boiler had already been built at the Cooke Locomotive Works.

The Erie officials are entertaining a general grievance of their employes, and we hope will be able to settle with them in a manner honorable to both sides. There was a new book of rules gotten out that the men were required to sign, among other rules was one wherein the signer agreed not to claim damages from the company in case of injury in the line of duty. It is not at all likely that this would stand in a trial, but it would have resulted in much annoyance and delay to injured men, and the men objected to it on general principles—and they were right. The Erie has suffered for some time from a scientific management that has frozen out some of their best men in the motive power department, and has economized on the head end, as usual.

Grading is being done on the cog-wheel railroad up the barren side of Pike's Peak, and the *Rocky Mountain News* describes the whole line, even going so far as to show a picture of the locomotive; they say it will be built on the Abt system, but show a picture of a locomotive of the Riggenbach system. The line may be completed next year.

Pedrick & Ayer, of Philadelphia have given this office a pen wiper on the general plan of the new green and gold flag of Bazil. In thus inferring that we use pens here, they charge us with being behind the age. We do not need a pen wiper—we want a better looking type writer, and a law preventing boys from learning the trade.

There is a division of the L. & N. that the old timers have dubbed the "kid division," because most of the men employed there are young. Supt. Dickson being less than 35. It has as good a reputation as the best, however.

Last month two sections of a delayed passenger train on the Northwestern road made some remarkable time West in order to make the connections with the "Overland flyer." The second section, with the baggage only, made 78 miles per hour during parts of the run.

It is a common practice in Great Britain to set the front ends of locomotive flues about 2" higher than the back end.

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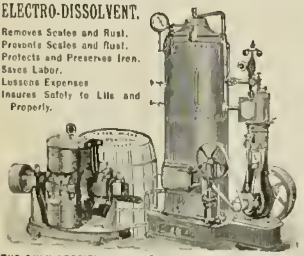

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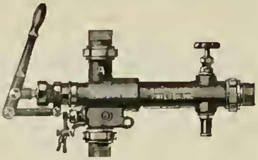

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VOL. III, NO 2. NEW YORK, FEBRUARY, 1890. $1.00 per Year or 10c. a copy.

Historical Locomotives—The Monster.

There are very few of the 75,000 enginemen in this country who ever saw one of the four locomotives that were known as the "Monsters." The picture on this page was made from a tintype taken in the later days of the "Monsters," after they came into possession of the Pennsylvania Railway, and after they had gone through many changes, and is only used here to show how they looked in their old age, just before they were broken up.

The tintype was a dark one, and many of the parts obscured, but the picture shows the general complication—a sort of link motion having taken the place of the hook and cut-off, a pair of drivers been traded for a truck, and many minor changes made, but with all the modernizing it shows a strange looking "Monster" to be prowling around our railroads at as late a day as 1875.

The original "Monster" was built by the Camden & Amboy Railroad Co. in 1834 She was commenced at Hoboken in 1333, and the partially finished pieces were moved with the shops to Bordentown, N. J., where she was put into service the following year.

In 1838 the "Monster," with all the other motive power of the Camden & Amboy road, including all their steam vessels, came under the hand of Mr. Isaac Dripps, now of Philadelphia, as Superintendent of Machinery, he having had charge of repairs for some years before this, and Mr. Dripps was one of the first, if not the first man, to bear the title of Superintendent of Machinery on the American continent. Mr. Dripps soon had the "Monster" to rebuild, and, in doing so, made some changes—especially in her boiler

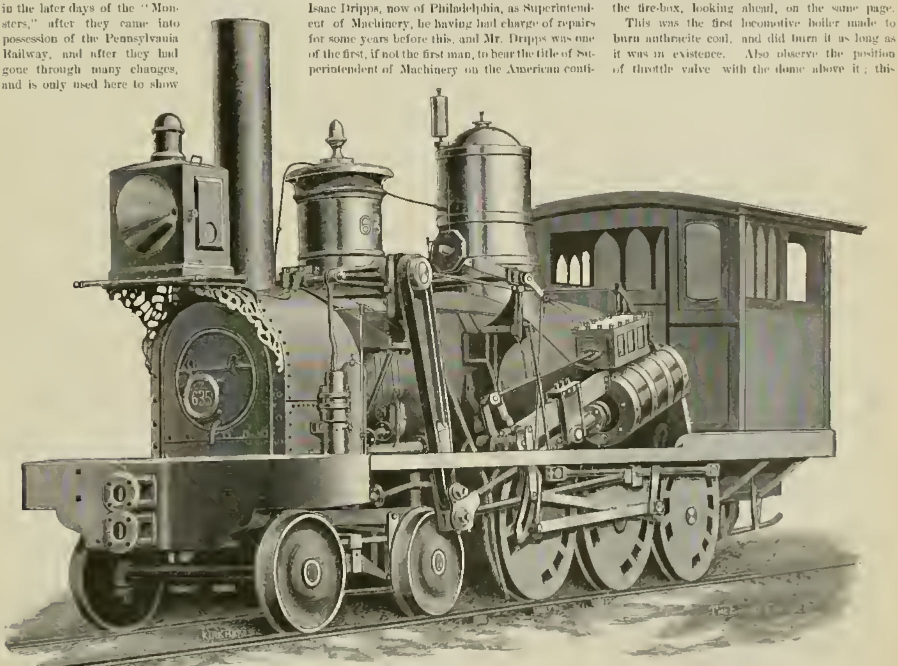
On page 22 will be found an outline drawing of this engine, taken from the old shop drawings, on tough paper, made at that time by Mr Dripps. The lettering and all on the card is reproduced. It will be seen that the plan was considerably different from that used in the final one, shown on the first page

On page 21 will be found drawings, as then made, of the original boiler, and the changes made in it by Mr. Dripps.

Looking at the old boiler, you will see that it has a combustion chamber ahead of the fire-box, there was a partition, or water-leg, ahead of the grates, and then the chamber. In the center of this bridge, or partition, there was a large, flanged pipe up to the crown sheet, to promote circulation. This is plainly seen in the small end view through the fire-box, looking ahead, on the same page.

This was the first locomotive boiler made to burn anthracite coal, and did burn it as long as it was in existence. Also observe the position of throttle valve with the dome above it; this dome blew off, and Mr. Dripps recalls the incident. The engine had just returned from a wreck, and a crowd of men were standing around her, Mr. Dripps among the rest, the light, cast, flange gave way and the dome went skyward to a great height; the rush of steam *up* produced a partial vacuum, and the air rushing in to fill it threw all the men down *toward* the engine, their hats being especially lively. Afterward there was great discussion among the laborers about how a boiler could blow up and blow people *toward* it.

This dome and throttle were replaced by the arrangement shown in the top cut.



"The Monster."

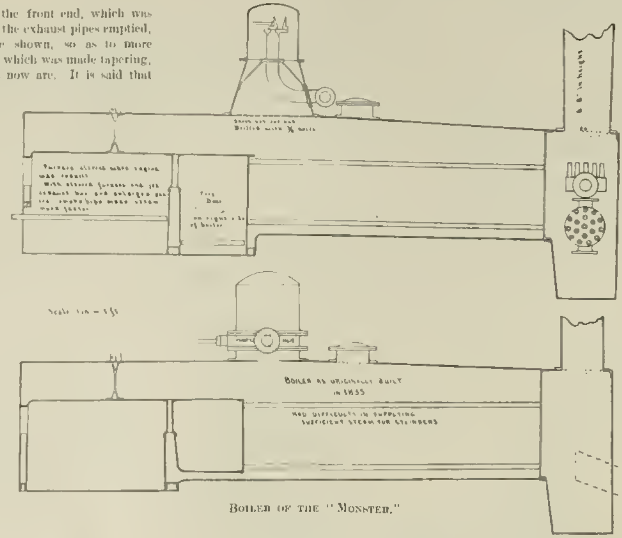
Mr. Dripps was convinced that there was not grate surface enough, and got more in a novel way—he put grates in the combustion chamber and a fire-door on the right side, and run two fire-boxes, and says that, whatever else the engine was, she was a very satisfactory one as far as steaming was concerned after that.

The nozzle stand in the front end, which was merely a box into which the exhaust pipes emptied, was made in the shape shown, so as to more effectually fill the stack, which was made tapering, as many straight stacks now are. It is said that the engineers used to plug up some of these little nozzles with pine plugs, so that the modern nozzle fiend is not the first and original. The crown stays of these boilers were of the crow-foot pattern—a style almost unused now, but one that gave little trouble. Now look at the outline of the old "Monster" on page 23, and get the idea into your head. The vibrating beam, or "horse neck," as the boys called it, was ahead of the stack, and the whole engine further ahead than those afterward built, but the plan was much the same. There was a rod from crosshead to the knuckle on end of "horse-neck," that gave it its pendulum motion, then a main rod back to the third pair of wheels—all wheels under these engines were drivers—the two back pair were coupled together by side rods, as were also the two front pair by side rods of their own; between the second and third pair of wheels was an idle shaft, in the center of which was a huge gear wheel, meshing into corresponding gears on the second and third axle, as shown. The engine drove the third pair of wheels, the back side rods the back pair, the gear driving the second pair, and the front side rods the first pair. If the gear broke—and we are told it often did—half the tractive power of the engine was gone. It will be noticed that the side rods on one pair of wheels were set opposite the other pair—one was above the center, while the other was below.

The valve motion was driven from a return crank on the main pin, as shown in the rear view on page 23; it will be seen that this return crank carries an eccentric as well as a pin—the eccentric moved one of the drop hooks, the pin the other, being the first time this arrangement was ever used. The reversing gear is not shown.

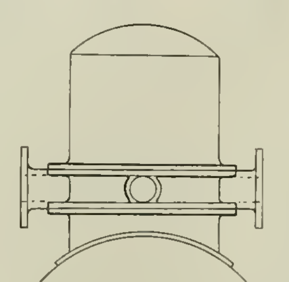
The cut-off was effected by a valve riding on the back of the main valve, like other cut-off engines of the day. This cut-off was driven from a pin on the "horse neck," and was handled from the cab by the levers shown, one on each side, and the tumbling shaft and arms just back of the stack; it was in detail very similar, if not just like, the cut-off shown in The Locomotive Engineer in February last. This cut-off mechanism was designed by Mr. Dripps, and the first one applied to the "Monster." This same motion was afterward used on the eight foot wheeled Norris engines, which were designed by Mr. Dripps. It was afterward applied to many locomotives, especially by Norris, and became known as the Norris cut-off. The pump in the original engine was driven from the horse-neck and was located near the fire-box. On the later engines it was located and driven as shown on title page cut.

In 1858 the Trenton Locomotive Works were established, and Mr. Dripps, who was one of the firm, was made superintendent, and these works built three more "Monsters," though much better ones than the first. We have before us, as we write, part of the original drawings used in these works. They were once very fine drawings, on parchment paper, different materials represented by different colors, brush-shaded, and every detail complete; but they have lain in cellars and garrets for nearly forty years, and they are mildewed and broken, many important parts being gone, so that our engravers could do nothing with them—a fact we regret.



Boiler of the "Monster."

These engravings show that the guides were V shaped top and bottom, that the four back driving-boxes had wedges, but the four forward ones none; that a well-made and well-proportioned cab was used on the "Monsters"; that the large copper exhaust pipes on each side had the feed pipe running through them to heat the feed water; there was no frame, the jaws or pedestal for each box was riveted to the boiler itself, the driving-box jaws were of the slab type, two plates with shoes on their edges, and the main rod was trussed like a beam engine rod. All the rods were of round section.



"Monster's" Boiler, Looking Ahead, through Fire-Box.

The "Monster" was not a successful experiment, but did fairly good work, and would have done better on a good track—she was too heavy for the tracks then used. But the "Monster" is not one whit further from being a good locomotive than some of the later day experiments, and by turning the cylinders around, and putting some of the surplus drivers on top of one another, one of them could be sold in the dusk for a Fontaine engine—and that was going to revolutionize the world only a few years back.

There were 1,860 locomotives built by regular locomotive works in this country last year. It is impossible to get data of the number built by the different roads, but the number would certainly bring the total number built up to 2,000. Baldwins lead with over 900.

Some New Engines on the Old Colony.

Some new 8-wheeled locomotives, turned out of the Boston shops of the Old Colony road, are very handsome and substantial looking pieces of machinery. All the motion is extra heavy and plain; the Dean guide, a solid cast-iron box, is used; they are 18x24, with all modern improvements. The guide yoke is fast to side of boiler, and does not reach across frame. The tender has two flanges around the top, one outside and another around the coal space; this allows the top of tank to be kept clean, and tools thrown there are not lost or covered up. Trucks are very heavy, with roller bearings. Shoes are large and fit solid top and bottom at each side of the box, a thin wedge is fitted behind the back shoe, there is no possibility of the wedge moving with the box, and thus sticking itself. A great deal of the cab fittings are, like the checks, left square—a shape we should think very easy to mar up and hard to clean. These engines are running with a single nozzle 4¼" in diameter. The tenders have heavy wrought-iron frames, and the whole engine presents a neat appearance. On this road there is a small, square iron bar across the center of the headlight glass outside, on which tin numbers are hung, to denote the number of the train the engine is pulling. Coal used is poor, but engines steam well. Plain paint with a light gold leaf stripe sets them off well; the motion work and interior of cab are painted green.

The trouble on the Erie has been settled by the company withdrawing the book of rules with the cast-iron death warrant. Another abuse that is tolerated there will soon cause the Erie officials trouble, and that is the plan of suspending men "pending investigation." Any measures the men may have to take to stop this abuse will be justified. When a man is reported to have violated a rule, he is supposed to be innocent until proven guilty, and it is despotism, pure and simple, that allows him to be punished in advance by suspension "pending investigation."

Hereafter the pages of this paper will number continuously through the year, so as to make the bound volumes and files more like a book.

"Great Locomotive Competition."

Under the above head, *Engineering*, of London, England, publishes the following communication:

To the Editor of Engineering:

SIR: Referring to the paragraph under this heading in your last week's Notes from the North, it will no doubt be of interest to your readers to learn that the invitations addressed to the seven chief locomotive builders in the United States, by the Engineering Committee of the Edinburgh International Exhibition, 1890, to send a representative American express engine for exhibition and practical trial, have all been declined, on the ground that the expense would exceed any benefits likely to accrue. Since the success of an American engine in competition with those of the British build would constitute a world-wide advertisement for its makers, the accuracy of this conclusion may be doubted. Even the famous Baldwin Company decline, on the score of expense. The invitations provided for the American engines being worked throughout by American engineers, and stated that fair play in every respect would be guaranteed.

There can be no doubt that trials of an American engine over some of the British railways would be most interesting and improving to those concerned in railway working on both sides of the Atlantic, it being calculated to bring out the good and bad points of each type, and so lead to mutual improvement, and the Engineering Committee consider that, if expense is the only obstacle, it may still be possible to bring the trials about. A letter is now in the post, inquiring of the Baldwin Company whether they would send an engine if all expenses were paid. It would not be possible for the Executive Council of the Exhibition to guarantee all the expenses, but it is expected that one of the great steamship lines trading to New York would undertake the transport to and from Great Britain free. This would be the chief item, and it is suggested that the balance might be made up by subscription amongst those interested in railway machinery on both sides of the Atlantic. When the idea was first mooted, Americans in this country hailed it enthusiastically, and expressed confidence that an engine would not only be sent, but that it would be backed to beat the British ones to the tune of hundreds of thousands of dollars. It would seem that a change has since come over these views; but still it might reasonably be imagined that a sufficient number of public-spirited Americans could be found to provide the necessary funds to recoup the Baldwin Company for the outlay. Even should freight have to be paid on the engine, the total expense could not well exceed $5,000—a mere bagatelle to set against the loss of prestige to American builders which the declining of such an invitation must involve.

I am, sir, yours, etc.,

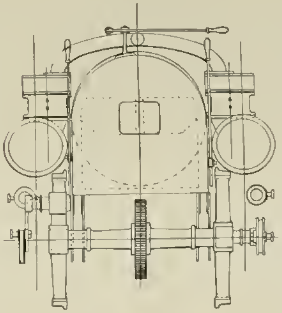
GEORGE E. WATSON, Sec

40 *Frederick Street, Edinburgh, Dec.* 31, 1889.

This is putting it pretty strong, and we hope some of our builders will take the matter up and build a winner—which we think they easily could

Of course there is no field open in Europe for the sale of American-built locomotives, but English, Scotch and German locomotives are largely sold in South American and other countries in competition with American locomotives, and to beat them on their own roads would be worth thousands of dollars to the winner, in advertising alone.

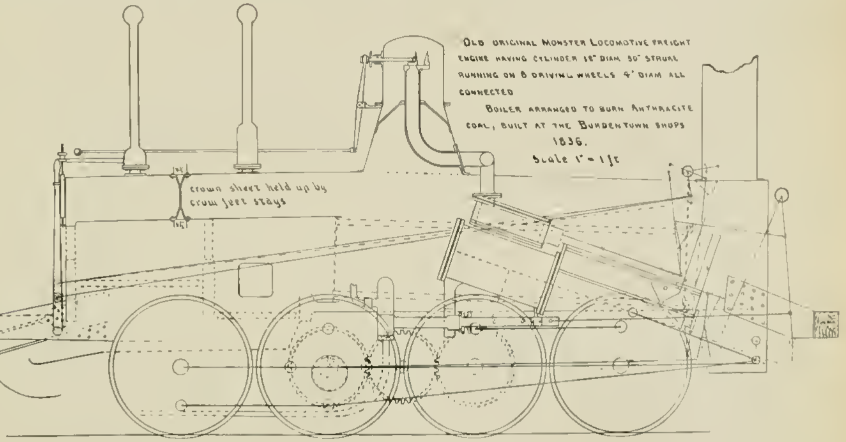
In comparison with European locomotives, our



THE "MONSTER," LOOKING AHEAD, THROUGH MAIN AXLE.

build are far superior in handiness and accessibility for repairs, as well as being cheaper; but the plain, honest fact of the matter is that American railroad men have been making lots of fun of English-built engines without any grounds except their appearance and our prejudice. Such of their machines as have come here have been, in the main, experiments, and failures here as well as at home. Their standard locomotives do a good deal of work, and "get there," but whether or no our locomotives would not do their work cheaper for a term of years is an open question.

The thing now is that cousin John has a chip on his shoulder, and swelling around daring any Yankee locomotive builder to knock it off and whip him on his own ground. When a man thinks he can't be licked, the easiest way to argue with him is to do the licking. Nobody afraid of the English engine, is there?



ORIGINAL "MONSTER"

We desire to say to the many who have inquired about price and time it will take to furnish the valve motion model shown in the December number, that Pedrick & Ayer, of Philadelphia, have complete control of the building and selling of the machines. Please apply direct to them.

The Swinerton Polygonal Driving Wheels.

About two years ago a Boston syndicate brought out the invention of Mr. C. E. Swinerton in locomotive driving wheels, and had the locomotive "Onward" built at the Hinkley works in that city.

The invention consists in the making of the face of the tire in flat facets instead of turning them round. The "Onward's" wheels have, or had, 105 flat spots about one inch long on them.

The claim is made that this arrangement allows more surface of the wheel to be in contact with the rail, and thus produces more adhesion.

This is directly against the established laws of friction. The surface in contact does not affect the adhesion unless one piece be so sharp as to cut into the other—a brick can be drawn over a board just as easy on its side as on its edge or end—weight governs the adhesion. Mr. Swinerton claims that this law holds good up to a certain point, then it is wrong.

This paper or its editor have no hobbies to ride or axe to grind in this or any other matter. We want to know the truth, and publish it for the entertainment and instruction of our readers, and propose to tell it as we find it, regardless of consequences. We shall be glad to make a favorable report of the polygonal wheel if we are convinced that it has any merits whatever. At present we are not so convinced. The comparison of the "Onward" with other engines is no test at all; she is altogether different, and there is no doubt that a locomotive with a single pair of wheels will do better under many circumstances than one with coupled wheels, except, perhaps, on the start

The Manhattan Elevated road have received a set of these tires for one of their engines, and the tests of merit need not take a day. By fastening the engine to a buffer-post with a dynamometer between it and the post, carefully noting the pressure, water line, etc., and letting her pull on the dynamometer in competition with another engine just like her, with plain wheels, the difference in adhesion will show up, if there is any.

Prominent men who have had opportunities to test the matter have endorsed the invention, however, and a friend of this paper who witnessed the tests and rode on the "Onward," calls our attention to the following notice from the Boston *Evening Traveler*:

Mr. George W. Tilton, superintendent of motive power and machinery of the Chicago & Northwestern Railroad, by the invitation of the directors of the Swinerton Locomotive Driving Wheel Co., was present at a meeting of the board at the Revere House lately.

Mr. Tilton stated that he was familiar to some extent with the practical working of the polygonal wheels, having witnessed their operation under the locomotive "Onward," and also that he had critically reviewed the detailed report of the recent trial tests of the polygonal and smooth driving wheels in comparison under locomotive "Onward," on the Boston & Maine Railroad, as well as the deductions made by Mr. John E. Clarke, Ph. D., of Boston. From data obtained from these tests, and in view of the above, he gave it as his opinion that the ordinary eight-wheel coupled locomotive could draw on an average from 10 to 15 per cent. additional tonnage if equipped with the polygonal wheels

A new machine will be built at once by order of the directors, and will be used by Mr. Tilton in cutting driving wheels on the Chicago & N W It would appear that the use of the wheels thus cut will very soon become general on the principal railroads.

The same gentleman has kindly furnished us with copies of the following letters, which tell their own story

Despite all this, we cannot help but think that something about the "Onward" beside the tire is responsible for the results apparently obtained

Boston, Nov. 13th, 1889.

I ran the engine "Onward" in the recent tests made on the B & M. R. R., both with the Swinerton polygonal wheels, and after the wheels were turned smooth. It did good work, both freight and passenger, with the polygonal wheels, but after the wheels were turned smooth or round I found the engine practically useless, on account of drivers slipping so badly I also ran the freight engine "Beach Bluff" equipped with the polygonal wheels in the worst weather last winter, and had no occasion to use sand

L. C TODD,
Engineer B. & M. R. R.

Boston, Nov. 13th

I am running the engine "Beach Bluff" equipped with the Swinerton polygonal wheels, and I know that the device adds largely to the traction of the engine. My run, one way, is a night run with a heavy freight, and I have a good chance to know the value of these wheels

W E DUNLAP
Engineer B. & M R. R.

Boston & Maine Railroad, Office of Supt M. P. & M.

MR C E. SWINERTON, Prest. Swinerton L. D. W. Co.:

MY DEAR SIR: Replying to your inquiry of recent date, the locomotive "Onward" commenced her regular trips on our Portland express January 7th, 1889, and was taken off July 6th, 1889, after running just six months.

Her performance on this train gave good satisfaction, and she made her time The train is a four (4) hour train, distance 115 miles with 15 stops; number of cars 6 to 8.

Yours truly,
WM SMITH, Supt. M P & M

Chicago, July 29th, 1889.

MR C E. SWINERTON, Boston, Mass.,

DEAR SIR: Your favor of the 26th duly received, and I thank you very much for sending me a full and complete report of the performance of the "Onward" in the thorough, severe, and I will also add conclusive tests the engine has been subjected to. It is all you could ask or expect, and I presume more than many expected. The performance of the engine is simply wonderful, and I am sure no one is more pleased and satisfied with the results than I am with the manner in which the tests have been conducted in every detail.

If your improvement had but increased the hauling capacity of locomotives fifty tons of revenue freight per train, the saving would be enormous in that item alone, saying nothing about the saving in fuel, rail wear, and wear and tear to machinery incidental to slipping, and many other factors that have an important bearing in the matter, but it seems to me that the results of this test must disarm all adverse criticism, and at least impress upon the minds of the critics that, in the language of the Rev. Jasper (the colored preacher of Richmond), "the world do move, if the sun don't."

I think I can realize something of the feeling of satisfaction you and those connected with you have over the results of the test

Hoping to have the pleasure of seeing you in the near future, I am yours truly,

G W TILTON,
S. M P. & M., Chicago & N W R. R.

The polygonal wheel is too close to a practical test right before our eyes to condemn or commend it until that test is over. We have no interest in the matter except to state the facts.

Some Experience with the Belpaire Boiler.

BY AN EX-RAILROADER.

Some years since, I was connected, in an official capacity, with the motive power department of one of our trunk lines, and one of the first to use the Belpaire form of boiler in this country.

The square shell around a square fire-box, with straight and direct stays, seemed at once a good thing to me. I was tired of the crown bar, and the endless trouble with mud, the expense of the device, and the weight, but I was not then prepared to trust the radial stay. The latter, I am free to confess, are giving remarkable service in some sections of the country, but the many angles at which the different rows of stays must be riveted to the sheets, to say nothing of the difficulty of properly tapping the sheets to receive them, still kept me fearful of results

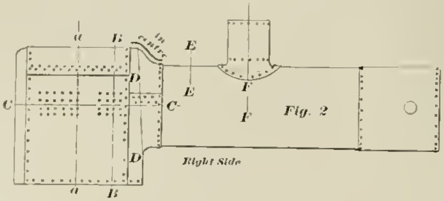
I had charge of the boiler work, and kept very close watch of the new form of fire-box—or rather outside shell—for the fire-box is like any other.

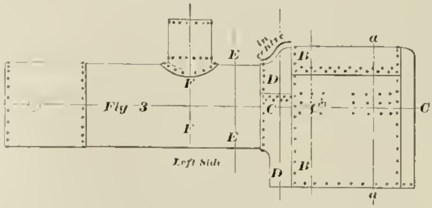
They were in passenger service, but only carrying 140—now considered rather low pressure.

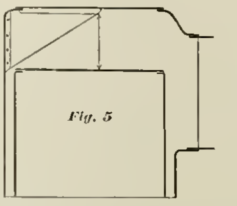
Some of the rivets in seams on top of boiler leaked after a time, and there soon developed a slight leak on top seam, where wagon-top sheet joins first course in the barrel of the boiler.

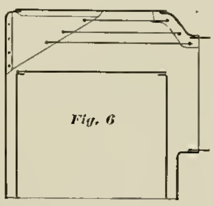
After a year or more of service, one of these engines came in for repairs, and a thorough inspection was made, and I commenced to experiment.

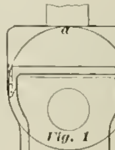
Hydraulic pressure at once showed that there was a decided "bulge" over this spot—just where the flat top of boiler and barrel come together. The boiler was "straight"—no wagon-top—and, looking endwise, the sheets would appear like Fig 1 at *a*.

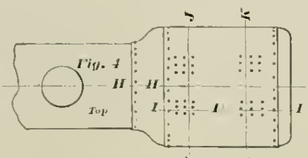












Why the "bulge" there? It was not hard to reason that out. We all know that when pressure is applied to the interior of a closed vessel—like a boiler—the pressure, being alike in all directions, tends to force the vessel into a spherical form. The round part of a boiler is braced against itself in every way, but flat places in a boiler must be strongly stayed, to prevent them from being distorted by the pressure.

Now, from the front row of stay bolts from the shell to the crown sheet, there is fully ten inches to the point where the throat sheet joins the barrel, or rounded part of the boiler; and this flat, or partly flat surface is entirely unstayed. At the corners, the throat sheet drops abruptly, and have a stay from the central point to the back head; but the flat place at the top is unprovided for.

We found this trouble in all the Belpaire boilers with the straight top, and cured it by riveting a piece of heavy **T** iron 6 inches wide and 24 long, on the underside of shell—resolved to buy no more Belpaire boilers with a straight top. As an experiment, we built one boiler with a high wagon-top, and I resolved to test it thoroughly, before it was put into service, to this end, I set it up as it would be in service.

When the boiler was ready templates or straight edges were fitted to it, at the points shown by the lettered lines on the engravings, Figs. 2, 3 and 4.

Two up the sides on flat part, one fitted to the throat sheet up the side, one down the top, two on rounded part of boiler, and one across wagon-top sheet lengthwise; this was not exactly in the center, because the throttle stand was in the way, but it was near enough for my purpose. (See top view of boiler, Fig. 4.)

The boiler was then filled with water and steam turned on, and temperature raised to about 212, when the templates were again refitted to the boiler at that temperature. At that time the hydraulic pressure was put on the boiler, and every change between the sheets, on the lines mentioned, and the templates was noted carefully until the pressure had reached 200 pounds.

On the right side, along the lettered lines, there was no change whatever. On the left side, no change, except on lines *B*, *B*, and *C*, *C*, there was a bulge of $\frac{1}{16}$ of an inch at the intersection of these lines at *C* 1. Here the sheet commenced to bulge at 130 pounds. On top, the line in center of throat sheet *H H* was the only one that did not suffer On the line *I I* at *I* 1, the sheet went *down* $\frac{1}{8}$ of an inch, on the line *J J*, sheet dropped $\frac{1}{16}$ in the center, as it also did at *K K*. I sent a man into the fire-box—the crown sheet was *down* there $\frac{1}{8}$ of an inch—what caused it?

If you will note the construction of the boiler, the back head is stayed by gusset stays, riveted to the outer top shell (see Fig 5). Any pressure on the back head must exert through the gusset sheet stays on the top sheet. The pressure on the top sheet and top of crown sheet being equal, there is nothing to counter balance the pull through the gusset sheets from the back head. The natural assumption would be, then, that the only resistance to any outward movement to the back head would be its own stiffness, and that due to the gusset stays riveted to it, and to the resistance through the gusset stays from the top, outer shell of the fire-box This resistance was not quite equal to the pressure on the back head, and the result was, in my opinion, that this pressure pulled down through the gusset stays on the outer top sheet, and through the stay bolts on to the crown sheet of the fire-box, which is proven by the depression in the fire-box being equal to that in the top sheet. The crown and wagon-top sheets had no power to move both sheets the same way; one pressure was equalized by the other.

What caused the left side-sheet to bulge, is not easily answered; it was very slight, and was, no doubt, caused by some slight tension on the sheets or other structural cause.

We riveted several heavy angle irons to the inside of throat sheet—as at *H H*—and ran the two rows of stays from gussets on the back head across to them, in almost a direct line.

There is a flat spot, not stayed, at each side of such a boiler, as well as at the top, and we provided for it by riveting to each side a heavy angle iron, and putting a brace between them, as shown in Fig. 1; this brace was just high enough to escape the top row of flues.

After these changes, the boiler stood 200 pounds pressure without a quiver, and, so far as this form of boiler is concerned, in comparison with other forms in our service, it has done fully as well as the best.

The *World* had a reporter in the recent snow blockade on the C. P., he is a mechanic (?) or has an eye for mechanics—a blind eye. He describes the rotary snow plow as said to be able to make 60 miles per hour through 10 feet of snow, and tells how it started out, with several big locomotives behind it, "and your reporter on the pilot!" and —was stuck before it got 600 feet. Then the engines got out of water, and "a gang of shovelers were sent to fill the boilers with snow." Oh, dear! Oh, dear! No wonder they are stuck fast, with "prospects of staying several days."

Extension Front Used by the Union Pacific.

The accompanying cut shows the U. P. adaptation of the Barnes extension front. The arrangement has some interesting features, notably the large area of netting, all arranged ahead of the nozzle, which is lower than those generally used on extensions. As will be seen, the diaphragm drops from above the flues to a line just below the top of the nozzle, and then, at a less angle, to a point only 17 inches from the bottom of the front at the center; this plate is fastened to angle irons by bolts. A solid plate extends from the front side of the diaphragm to a point just ahead of the nozzle, where the perforated sheet, that takes the place of a wire netting, commences, and extends well toward the front, where it is fastened to a solid cross-piece and from the top of which another perforated sheet extends back at an angle just sufficient to bring it to the top short of the stack; this gives a very large area of screen, as the main sheet is almost in the center of the arch, at the widest point.

The nozzle stands only 4⅜ths of an inch above the netting and 2 inches above the center line of the boiler, above it is a short draught pipe as shown, 24 inches wide at the base and tapering down to 10 inches at the top in a length of but 20 inches. This petticoat pipe is raised and lowered by the handles extending up through the arch each side of the stack, and held by screws. The success of working of this device, discharging the exhaust from a ten-inch draught pipe right at the base of an 18 inch stack, rather knocks the argument of those who advocate some scheme to make the exhaust fill the stack at the base, to pieces.

A great deal of care is exercised in putting these front ends together, every precaution to prevent the plates warping in such a way as to open a seam, or any place where cinders could escape, is taken, angle irons stiffen the whole arrangement, and it is fastened to the nozzle and extra cross-braces. The cinder slide is that known as the Barnes, being simply a flat iron piece, held against the mouth of the hopper by a half elliptic spring; the mouth of the hopper is double, simply two round holes side and side; the bolt that holds the cover being between the holes; when this piece is pushed in either direction it uncovers the holes. This slide cannot stick, get lost, or work open on the road.

Fig. 3 on page 32 shows a section of the perforated plate, full size; this is always arranged in the front, so that the slots are across the boiler; as will be seen, the slots are a quarter of an inch by an inch and a quarter.

As the sizes are given on the engraving, it is not necessary to describe the front at any great length. They are giving good satisfaction on the road.

We are in receipt of the Annual Report of the Railway Commissioner of Michigan, for which we have to thank our correspondent, Clinton B. Conger, mechanical engineer on the board.

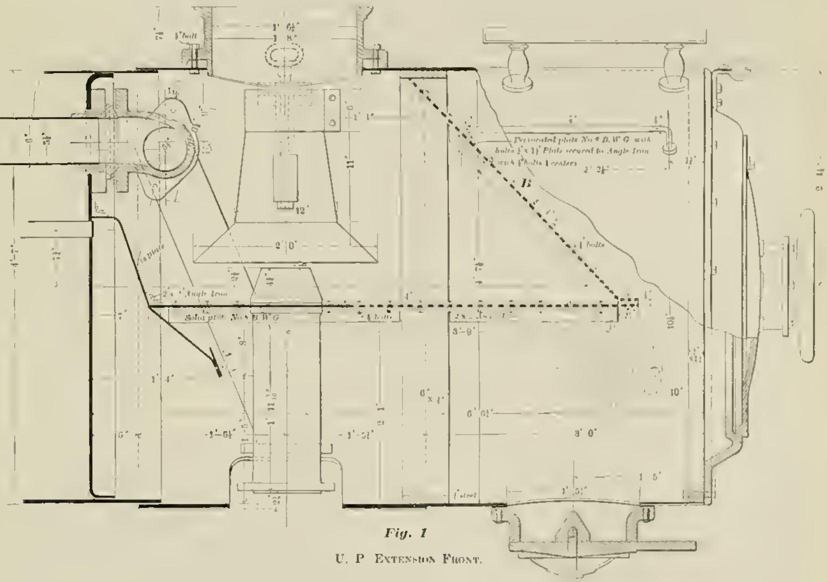


Fig. 1

U. P. EXTENSION FRONT.

We had some trouble with domes, on all classes of boilers, and in a future paper I will tell you how we went at it to find out what the matter was, and how we treated the disease after we found out.

Big Enough.

The mileage of the St. Paul system, now aggregates 566,905 miles.—*Journal of Railway Appliances.*

One road, that has over three times as many miles of track as there are in the United States, and much more than there is on the face of the earth, ought to be counted as large—exceedingly large.

On the New York, New Haven & Hartford road the engines are provided with a handle on right side of tank-head to open and close the cock in back end of air-brake pipe on tender. Men on the engines can close the cock themselves, and see at a glance whether it is open or not. They are also provided with a cock to bleed the auxiliary drum on the tender. Men who have tried to make a run of cars, and found that the "gafter" had only closed the cock on the car, and when the hose was cut the tank brake went on with a slam, will appreciate the usefulness of this arrangement.

Simple Lessons in Drawing for the Shop.

By ORVILLE H. REYNOLDS.

FOURTH PAPER.

In practical drawing, several kinds of lines are used, among which are full lines, broken lines, dotted lines, and broken and dotted lines. A full line, however wide or narrow, is made by the instrument without removing it from the drawing until the line is finished, as *A B*, Fig. 6.

A broken line is made up of a series of short lines, say from an eighth to three-eighths inch long, having a space between about equal to the length of the line, as *C D*, Fig. 6. Much care is required to produce a creditable broken line. The broken line is used principally to connect like parts of different views on drawings.

The dotted line is what its name implies, and is made by raising and lowering the instrument in quick succession, producing a line as *E F*, Fig. 6. This line is used to show a hidden portion of a drawing, and makes a fine finish when skillfully done.

Broken and dotted lines are a series of short lines or dashes, followed by one or more dots, like *G H*, Fig. 6. This style of line is recognized almost universally as the correct thing for a center line, both on account of its singular form and beauty, and ease with which it can be made after a little practice.

Sections of materials used in construction are represented by diagonal lines drawn with the 45° triangle about $\frac{1}{16}$ inch apart (Fig. 7).

This figure represents three pieces in section. Some practice is necessary, by the way, to make a neat-looking section, owing to the difficulty of making the spaces equal; if there is any inequality in the spaces the eye catches it at once.

There seems to be no standard for showing *what* the different materials are, unless we except sections of wood, Fig. 8, each draftsman being a law unto himself.

The foregoing kinds of lines are embodied in the different sections shown, as wrought-iron, Fig. 9, steel, Fig. 10; cast-iron, Fig. 11 brass, Fig. 12. These sections are mades up from average modern practice, and are perhaps as close an approximation to general use as can be given; but it makes not much difference what method for showing sections is chosen in the absence of any recognized standard, for the material represented must be named before it can be admitted to the family of parts which go to make the perfect whole.

A cylindrical surface is shown by lines drawn close together at the edges, gradually widening the distance as the center is approached, receding portions being the darkest, Fig. 14.

The shading of a plane surface will not be covered here, for it is our purpose to make the lessons in outline only, with the exception noted above.

With these remarks on lines, this portion of the subject should be clear, and we leave it, to adopt a standard size sheet of paper to be used.

Our board is 20"x30". If now we cut a sheet of paper 14"x24", and pin it to the board centrally, we have a space of 3" between the edges of the board at sides and ends. With a due appreciation of high art, the paper should have a border line placed one inch from each edge, leaving a working space of 12" x22".

One of the principal beauties of a nicely executed drawing is the manner in which the views are arranged on the sheet; now here is an opportunity to exercise a little taste. The symmetry of the whole, when finished, pays for all trouble in this direction.

In the adoption of this standard size of sheet there must be no haphazard arrangement of the exercises, for the size is such that care must be used, or they will contain too few lessons.

The arrangement of the views in this lesson will convey a clear idea of what is intended in the above.

The drawing should be so disposed on the sheet as to leave not less than one inch between it and the border line, arranging so as to leave a space at the lower right-hand corner for the inscription, the scale at which the drawing was made, and the date of completion.

The inscription should state in clear terms what the drawing represents. The style of the inscription is a matter which can be left to the individual taste, but it will not be out of place to say that the less ambitious attempts that are made to that end, will give more time for good work on the drawing. Nothing ornate is required. The finest inscriptions are those which are severely plain, where no embellishment whatever is attempted. It is often the case that, when a drawing has a title rivaling a circus poster in splendor, that there is something wanting either in execution or accuracy in the make-up of the drawing.

A plain title is made by drawing two parallel lines with the T square about ¼" apart, and making the block letters free-hand, *i. e.*, without the aid of the instruments, in pencil first, and using a 303 Gillott steel pen with the ink.

The scale used, and the date below it, should be made in plain script, also free-hand, after making three parallel lines—the two outer ones about $\frac{3}{16}$" apart, to designate the height of letter, and the middle one slightly nearest the top. An example of above is shown in Fig 15.

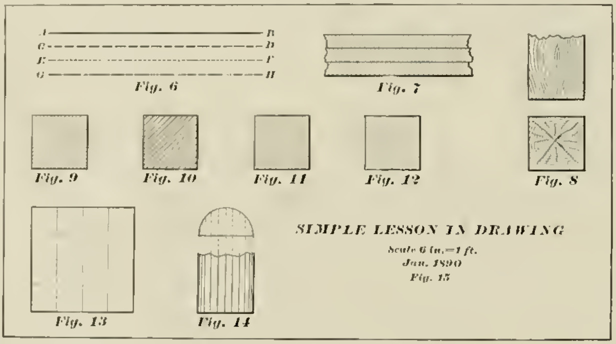
The necessary preliminaries are now arranged for the first lesson, which, to familiarize the student with the handling of a few plain figures, will embrace the exercises shown.

To draw Fig. 6, erect two perpendiculars with the triangle—in this case about 4" apart—which makes a point to start and stop the lines, following the description given in first mention of the figure.

To draw Fig. 7, produce three parallel lines any distance, as 3 inches, connect the ends by an irregular line, and alternate the direction of diagonal lines drawn with 45° triangle.

Fig. 8 is made by drawing two parallel lines about one inch apart, and erecting two perpendiculars, also about about one inch apart. In representing the grain, use the 303 pen to make the concentric circles, and from the center make radial lines. This is a transverse section of wood.

To draw the longitudinal section of this figure, make two parallel lines with the T square as before, showing one end square and the other broken, using the writing pen again, to represent the grain in wavy lines.



Figs. 9, 10, 11 and 12 are drawn in outline similar to Fig. 8, after which the diagonal lines are made with the 45° triangle.

To construct Fig. 14, mark off any number of points equally on a semi-circle, and through the points draw perpendiculars to the diameter.

The spacing is mentioned to show the principle; it can be omitted in practice.

To construct Fig. 13, draw with the T square two parallel lines, about two inches apart; erect two perpendiculars, also two inches apart, and cutting the parallels; divide two adjacent sides into any number of equal parts; through these points draw lines.

Let the student make an earnest endeavor to follow this lesson and give his attention to placing the figures as close to the arrangement shown as possible, and not be discouraged if the first attempt is crude, but place another sheet on the board, and go at it manfully, with a determination to succeed. Victory will surely perch on his banner in the exercises to come.

On the N. Y. & N. E., many of the solid-ended side rods have the eye at each end separate from the rod, having straps that are bolted to the rod. Probably put on rods having the old strap and half brass.

An English syndicate have been making some pretty big bids for American locomotive works. This is no joke; we know whereof we speak.

Correspondence

A Kink for Keeping Cab Windows Clear of Snow.

Editor The Locomotive Engineer:

In looking over THE LOCOMOTIVE ENGINEER for January, I noticed an article headed, "A Wrong Idea." Now I am not a machinist, nor yet an engineer, but a fireman who tries to keep track of a few of the kinks the article speaks of.

I make it a point to keep the furnace door shut whenever we approach switches, railroad crossings, highways, etc., on night runs. I like to see ahead as well as any engineer running. We have a device in use here, on the Detroit, Lansing & Northern Railroad, to keep snow off the front windows, which, though not new, may be of use to some of the boys. Take a piece of ¼-inch round iron eight inches long, heat and flatten two and a half inches of one end, bend square across, and punch through two holes, fasten on with screws a narrow strip of wood eight inches long with a strip of rubber nailed to the edge full length. Now bore a hole through window-sash close to the edge of glass, and about middle of window; run the rod through and bend down the end on inside, and you will have a device to keep window clear, that any one who ever rode on a locomotive in a snowstorm will fully appreciate. By moving the end of rod inside the cab a clear place can be kept on the outside of glass, as the rubber cleans off the snow. In cold weather we keep a piece of canvas nailed to coal gate on top, and weighted at bottom, which keeps out a lot of coal-dust and cold, and well pays in comfort for the little trouble it makes.

A FIREMAN

Howard City, Mich.

[Here is a simple little kink worth trying. The writer has opened the front door and wiped a clean space on the glass milli—well, hundreds of times, anyway.]

About Testing Locomotives.

Editor The Locomotive Engineer:

While reading in the *Railway Review* a description and account of the performances of the compound engine built for the Michigan Central Ry., at the Schenectady Locomotive Works, my thoughts wandered back several months, and the description and accounts of a certain remarkable run made by the *late* Strong locomotive (I say late Strong locomotive, because it was generally behind time), as published by the same paper, came to mind.

I wondered if the final outcome of this engine, would fall as far below the published accounts as the Strong has done.

There is no better way of judging the future than by the past, and the value of reports is governed by the source from which they come. Should this be the case with the Michigan Central compound, it would be pitiful indeed, and better things are hoped and expected of it.

There is much credit due the officers of the M C. Ry., as well as the Schenectady Locomotive Works, for making an effort to solve the much disputed problem of compounding the locomotive.

There may be, and no doubt are many changes to be made, before a decision can be reached in the matter, and if it were possible to have accurate statements of what the engines perform in the different trials, it would be very useful to every one interested in railways and railway machinery, and any mechanical paper, that furnishes the public with reliable news, will be putting itself in a position to *look down* when it tries to see its many competitors.

An ounce of information is of far greater value than pounds of misstatements, which are so common amongst the news furnished.

Anxiously waiting for further reports, I am

Cherry Hill, Pa. C. RITIC.

Which is Which?

Editor The Locomotive Engineer:

I quote from your issue of January, 1889, in reply to a correspondent's question as to the proper position in which to stand an engine when keying the back-end of main rod: "On the engine center, because the main pin is flat where it receives thrust and pull of piston, and is largest where least work is put upon it at the center." I have always held this opinion of the wear of a main pin; but, in a conversation recently with an old machinist here on the "Erie," a man who has the reputation of being one of the best on the road, I was informed that my line of reasoning was wrong. He said that in trying main pins with the calipers, he had found that they wore more on the center than at any other point. The reason of this was that the slap or pound of main rod, when passing the centers, caused a greater wear of the pin than was caused by the greater power exerted by the piston at the quarters.

"When doctors disagree who is to decide?" I shall look in your February number for the light which shall dispel the atmosphere of "comfuddleness" which at present envelops us. H. M.,

Fireman N. Y., L. E. & W.

Paterson, N. J.

[With a fast engine, generally cutting off at six or eight inches, there is little doubt that there is more pressure on the pin at or near the center than on a freight or switching engine that works most of the time at from a half to full stroke, wearing the pin more at or near the quarters. And on engines working between these extremes the pins will wear differently; at the point where the least strain is on the pin it will be found the largest, and may vary in different engines, but the great majority will be found largest on a horizontal line when they are at the centers. Perhaps some of our machinists can give us pointers on this; let us hear from you.]

The Good Old Times.

Editor The Locomotive Engineer:

The other day I got up on an engine that was coupled to a big passenger train, while the passengers were eating dinner, and had a talk with an old friend whom I knew when we were both firemen in 1870. We got to talking over old times, and my friend, who I will call "Doc," for short—although that is not his name—told me a doleful tale of the trouble he is having with the new-fangled machinery an engine has on at present.

"You need not tell me about the improvements in engines nowadays, for I can't see it. In the first place, look at those solid-end side rods, they are the biggest nuisance I ever struck. The little McQueen engine I had so long, after I was set up, had a regular built rod with straps and keys, and I used to go around them every trip, try the keys and set-screws to see if they were all tight, key them up as fast as the brasses got to working in the strap, and about once in six months have them reduced. Look at those solid rods, how are you going to key them up? And the worst of it is I will have to put up with them while I run this mill, for the bushings ain't a going to wear out in my time. I have had them a straight year, they have not got hot so far, and I guess they will never wear out. The rattle of them is enough to drive a man crazy; you can hear them farther than you can the bell, and it makes me tired to think they are going to last forever. There is the air-brake, it is getting so complicated, it takes a smart mechanic to understand what it is all for. I was examined by the travelling engineer the other day, and he took a triple valve all apart to show how it was made, and how it worked; there was a plumb twenty-nine pieces in it, besides two or three gaskets. After he got through asking me questions, he said I would pass all right, even if I could not explain *all* the ins and outs. When a fellow wants to stop awful bad, the air is the thing to have, and beats the Armstrong brake all hollow. My air gave out the other night, because the flange broke off the air-pipe where it joins the pump; that let the air out, and you can bet we soon stopped. The boys had to do the crank act from there in. My heart was in my mouth most of the way in, for fear something would happen, and we lost time at every stop. In the good old times we did not worry about that, because the 'shacks' then would stop us all right; but the fellows on passenger trains nowadays don't know anything about braking, they are only good for poking up stoves and helping the women off the cars. Then there is the driver brake, it works at the same time the train brake does; my hair stands up straight—N. B., Doc. is baldheaded—when I see the fire flying out of the driving wheels, but I can't help it. It ought to be a separate brake worked with steam or air, so a fellow could use it when he thought it necessary. You can bet I would not use it any oftener than I had to, for I don't go much on a driver brake. Some of these days she will strip herself on one side, and then where will the driver brake business go to? The steam heat business is a corker, if you look out now you can't see the hind end of the train for steam leaking out around the couplings. The conductor has to get up towards the engine to give a signal, because you can't always see him. That don't matter much, for the dispatcher has us held for orders about every time we stop, so he has to come over to the engine with the yellow paper. Time card rights don't amount to much nowadays. But about the steam heat. Last winter it was a holy terror, this season it ain't so bad. We did not have that to bother with in the good old times. This traveling engineer business beats me, though; the other day he came around and said I was using too much oil and coal. I asked him if the company was getting poor, but he did not mind that, and went on, saying that her nozzle was too small, he thought. That made me hot, and I told him it was too big, it ought to be made smaller, so she would bark right out sharp every time. He allowed that the day for barking out sharp had gone by, and there I ran up against another one of your modern improvements, for he had it made bigger the next trip. She steams pretty fair, and don't use quite so much coal and water, but the first cold night she will lay down. She is a bully steamer for a straight stack engine, and I suppose he will fool around with her nozzle and stack, trying to save a little coal, till he spoils her. But there is one of your modern improvements that is pretty fine, that is the electric crossing. It used to be a big job to stop at a railroad crossing, and we did not always do it, till three or four years ago. When they began to give a man his red ticket for not stopping at a railroad crossing it made it pretty binding. Now they are getting the interlocking switches in everywhere, I don't have to stop with a varnished car train once a week, and the beauty of it is, the other fellow can't run into you. Just the same, I feel nervous when I am crossing one, and keep my eye on the home signal and split rail. Most of the engines now have to haul too many cars for the size of their boilers. When you get a signal to go, you have to work them as hard as you can to make the time to the next stop; if you lose any time, the old man wants to know mighty quick what is the matter. Well, I must be going, so good-by till I see you again."

While my friend has an idea that, because anything is new and different from the old machinery, it is not so good, most of his objections arise from some other reason. Some of us have been traveling along in the same old rut so long that we hate to get out of it. While we see new ways of doing work to make it quicker and safer coming into use all around us, yet we sigh for the old crosshead pumps, diamond stacks, oil cups on the steam chests, etc., because it was lots of trouble to learn how to use the new equipment. My friend "Doc," while complaining about a good many devices that have come into use in the last ten years, did not give a single good reason against the fact that they could be successfully operated. He did not like to get out of his old rut. But it is a fact that the number of engineers who object to keeping up with the times is growing less each year, they are not dying off, *they are learning how*. Most of them welcome any new machinery that will make things any safer, even if it looks more complicated. "Let well enough alone" is a pretty good motto, but "Do the best you can, and look for better," is a sentiment more in keeping with railroad operations of to-day. The demand of to-day is for heavier trains and greater speed with trains closer together on a single track; if this demand is complied with, and *safety* made the first consideration, the old ways will have to be abandoned whenever they are not up to the standard. First cost is not looked at as closely as endurance and amount of service. Some methods look complicated when new, but after we study them up they are simple enough. Let us study up. C. B. CONGER.

Lansing, Mich.

Here Too, Mr. Campbell.

Editor The Locomotive Engineer:

Why is it that railroad companies imagine they must have a man in the locomotive department whose duty it shall be to ride back and forth over the road, to see how their engines are working, their general condition, and to instruct firemen in their duties? At the same time they keep a man, under pay, called division master mechanic, whose duties are identical with those of the traveling engineer. Ninety-nine times out of a hundred these two men are cut out of the same piece of cloth, namely, old runners, and neither of them practical mechanics, sometimes both doing duty on the same division, both bucking, both at swords' points the one with the other. I have seen a division master mechanic seclude himself, go off and pout, when the T. E. was making his "grand rounds."

The division master mechanic represents the general master mechanic; the T. E. does the same on the road, only a little more so. The T. E. rides on an engine and berates the poor fireman for burning so much coal; the T. E. jumps down, grabs the shovel, and says: "Let *me* show you how to fire", he opens the door, gives the shovel a circular motion, which brings the mouth of the shovel on a line with the top of the arch, the engine is working hard; result—if the coal is fine the exhaust picks it up and distributes the coal *on top* of the arch, and it is not long before the steam gauge begins to weaken, the engine gets tired, and wants to lie down and rest. The fireman was putting the coal on the fire, the T. E. put it on the arch; in his frantic efforts to instruct the fireman he loses sight of the fact that the engine is blowing badly, and that she has a three-cornered exhaust. If he notices these things at all, he thinks the division master mechanic should attend to them, but he don't tell him so; at the same time that is just what he was created for; but he thinks it is the master mechanic's business, and says, "Damficare."

The master mechanic sits in his office, and hears an engine go wheezing and limping along, but he says "Damficare; the T. E. is paid to get onto these things," although he was made master mechanic not only to sign the pay-rolls of his division, but to keep his engines up; but if he don't know and don't care, what can be expected?

There is one thing the T. E. can do—he can take advantage of his position to bulldoze some poor devil against whom he may have some private grudge. The man for a division master mechanic should be a good, practical machinist-runner, other things being equal. They would then know when an engine is in the right condition to go out of the back shop, so that the man who runs her can take a little comfort—their life is hard enough at best.

Putting up a locomotive according to the ideas of the back shop men, and what the real requirements of the road are, are two different things, and it is right here that the machinist-runner master mechanic can get in his work to advantage. But where the master mechanic is not a practical mechanic, and the foreman is not a practical engineer, and you mix in a few parts of traveling engineer, it makes a bitter pill for the boys to swallow.

The traveling engineer as a man I have nothing to say against, but I claim they are a useless appendage, so far as my own observations go.

The writer was pulling a late passenger train one night, and having to stop for orders, when I got ready to pull out, lo, and behold there was the traveling engineer on the engine—in itself bad enough—but, to make matters worse, he had jumped my seat, with the intention of piloting me over the last twenty miles of the road. I knew the road, had been there before with same train and engine, and at night; I asked myself the question, Will Ben never get up and let me have my place? but, like Poe's "Raven," echo answered, "Nevermore," and the animal sat there, and I had to run and look ahead as best I could.

Do I like the T. E.? not by a good deal.

W. DE SANNO, Engineer and Machinist.

Corry, Pa.

[Now this will probably stir up a discussion. please remember that in that case *facts* and *points*, not *opinions* and *assertions*, are what is wanted. Arguments educate, scolding degrades.]

The "Neversink" on the P. & R.

Editor The Locomotive Engineer:

The locomotive Neversink blew up on the Philadelphia & Reading Railroad early in the 50's, perhaps before that time. I recollect the circumstance very well, but forget particulars; think it happened at or near what is called Neversink curve, on the P. & R. W. DE SANNO.

Corry, Pa.

[Perhaps some of the older Reading men will remember about the Neversink.]

The Michigan Central Compound.

Editor The Locomotive Engineer:

Much has been written of the compound locomotive, of its fuel economy and the like. Many, no doubt, suppose it is an easy matter to get out such an engine that will do the work of the standard 8-wheeler, besides showing a considerable fuel economy. Enclosed I send you a report, from the *Detroit Free Press*, of the compound built by the Schenectady Locomotive Works for the Michigan Central Railroad. It will be seen that the engine consumed a little over seven tons of coal between Detroit and Michigan City, a distance of 228 miles, while standard engines use but little less from Jackson to Michigan City, a distance of 152. Surely this is the most successful compound yet built in the United States, so far as fuel economy is concerned.

Could not a considerable fuel economy be effected by using pressed coal on our engines, as is common in Europe. Among the locomotives at the Paris Exposition was a four cylinder engine exhibited by the Paris, Lyons & Mediterranean Railroad. Two of the cylinders were inside connected, and the other two were placed outside. The engine resembled an American locomotive, minus bell, pilot, etc. Size of cylinders 17x24 inches, diameter of boiler about 58 inches, drivers 72 inches in diameter. Total weight perhaps 80,000 pounds. Mr. Editor, do you think this engine was a compound? If so, does it not resemble the B. & O. engine? I believe in the compound, but it must not have any elaborate gearing, and be able to attain a good rate of speed. The M. C. engine has showed good fuel economy, but I have not heard of any very fast runs. These are my observations of the compound, and, as I am probably the youngest subscriber to your excellent paper, they don't amount to anything.

Detroit, Mich. GEORGE L. FLEITZ.

[Facts and observations are what we want, and are therefore glad to hear from this correspondent, and as it is the fact or the observation that we want, and not the recorder of the fact of observation, it makes no difference about the youth of the writer. Youth, age, sex, shape, size, hue, or previous condition of servitude makes no difference with the fact, be it told by one or all.]

Some Pointers from Jersey.

Editor The Locomotive Engineer:

One day last summer, while watching the arrival and departure of trains at Matawan, N. J., I was approached by a ministerial looking old gentleman, who asked me this question: "Why is it that, upon stopping here, some of the locomotives blow off steam at one end of the boiler, while others blow off at the opposite end? I have noticed particularly," he continued, "that the engines belonging to the Pennsylvania Co., while blowing off, emit a very subdued sound, and that it invariably proceeds from the chimney or smoke-stack, whilst the engines of the Central of N. J. do all their blowing from the top of the cupola like structure at the other end of the boiler. Can you explain this to me?" I said I could, and straightway proceeded to enlighten the old gentleman.

I pointed out the difference between a pop safety-valve and a blower, and how necessary they both were to a locomotive.

I said a P. R. R. engine depended on the blower to get its train over the road in time for the final resurrection, and, if he doubted my word, to get on the next train and ride as far as the mouth of Cheesequake Creek (Morgans), and watch the fireman claw for that blower valve as soon as the engineer shut off for the station.

The old gentleman seemed interested, and I gave him more food for thought. He admitted that he knew the difference between the sound produced by an epileptic man sawing wood, and the clean cut, well-timed roll of a drum. Then I likened the former to the sound of the exhaust of a Penna. R. R. engine, and the latter to one of the Central of N. J.

This ended our talk, as my train arrived, and I was compelled to bid my friend good-by.

Speaking of locomotives, it is a fact that there is one—that, when not undergoing repairs, pulls the early train through my native town; that, when hooked up to the fourth notch, has one less exhaust than the Webb compound on the Penna. R. R. In conversation with the engineer he said: "What can you expect, when valves are set on the piecework plan, and no one to see or care whether they are square or otherwise"; but he evidently derived some consolation from the fact that the engine was "standard."

An engineer told me, recently, that he one day had orders to relieve a certain young runner at M——, that, while oiling around, he discovered the crosshead pin on the engineer's side ready to drop out, the split-pin and nuts having fallen off somewhere up the line. He called the young runner's attention to it, when the latter exclaimed, "Yes, I know it. I've been watching it, and, if the pin had dropped out, was ready to catch her before she struck the cylinder head." BAY.

Matawan, N. J.

[Evidently the lightning engineers are not all dead yet.]

The Dimensions of a Radical.

Editor The Locomotive Engineer:

In January issue of THE LOCOMOTIVE ENGINEER, we find among correspondence, a contribution under heading: "A Radical View of the Traveling Engineer."

Has the true significance and imposing grandeur of a title ever dawned upon the observing readers of THE LOCOMOTIVE ENGINEER?

If not, we wish to give an example of the overpowering elegance of authority, and *assumed* wisdom of a titled individual down in Texas.

This individual signs himself E. A. Campbell, Superintendent of Motive Power and Machinery of the Houston, Eastern & Western Texas, and Shreveport & Houston Railroads.

This indeed makes a grand combination, but its grandeur becomes woefully modified when we find that this immense railway system is even smaller in length than the title which covers it, rivaled in turn by Mr. Campbell's overpowering wisdom.

This great railway system is an ordinary 3-feet narrow gauge railroad, embracing about one hundred and ninety miles, and with sixteen locomotives and 570 cars credited to its entire service.

Now let our kind readers again note the following, evolved from the fertile wisdom of Mr. Campbell's brain, or probably the sentiments may have been written by one of the boys just out of school, and Mr. C. may have offered it to the columns of THE LOCOMOTIVE ENGINEER, thinking his overpowering title might add *strength* to the production. Here it is, *verbatim*:

"A practical engineer ought to know that any M. M. who allows a traveling engineer, is not held in position on account of his good qualities as a mechanic or engineer. Did you ever know of a good practical engineer or M. M., who would employ a traveling engineer? Well, I guess not, unless a friend of his came along, and he has all the engineers that he can employ, then he picks up the idea he can employ him as traveling engineer; but as soon as he can give him a regular engine, good-by traveling engineer, until some other friend comes along. No master mechanic, who knows the duty of an engineer, will employ a traveling engineer. I am surprised that any superintendent would admit anything of the kind to be paid for on transportation rolls; but as long as companies will employ incompetent men for superintendents and master mechanics, such ignorance may be expected, as employing traveling engineers. I *do* think, in *my own opinion*, that money paid out to a traveling engineer is worse than that of paying out money for cylinder oil that makes 5,000 miles, and requires new valves and false valve seats for engines, also new packing for cylinders. A master mechanic should know the duties of an engineer before he accepts the position of M. M.; then a part of his duty is to know the condition of all his engines in his charge. His next duty is to keep those engines up in good repair, keep their valves square, and packing from blowing. The engineer's record, as to how he pulls a train, and handles his engine, will soon tell on him, then the M. M. can handle him without any go-between called a traveling engineer. When the M. M. does not know the duties of an engineer, I would advise him to employ a fireman that does.

Now, Mr. Editor, this will hit some M. M.'s pretty hard (especially the Supt. M. P. & M., of the H., E. & W. T., and S. & H. railway), but you just tell them to take my advice as to employing a fireman.

I have been a traveling engineer in pay of the company, and I have also been a traveling engineer without pay, and *I think*, in *my own* mind, that railroad companies were making more money when *I was* a traveling engineer *without any pay*, and common engineers were happy."

Your readers will not have to ponder very long, before accepting the striking candor and truthfulness of this last paragraph.

Now, when one takes into consideration the extent of the railway system over which Mr. Campbell throws the mantle of his divine title and sublime authority (190 miles, 16 locomotives and 570 cars), such sentiments do not seem out of order, and it would be strange if *one* man of ordinary intelligence could not be superintendent of motive power and machinery, master mechanic, general foreman of shops, and traveling engineer combined and then not overtax the physical energies or nervous system in the least.

When Mr. Campbell acted as traveling engineer *without* pay, he probably earned all he was worth, whether in service or *simply rustling for a job*.

"Eyes and see not, ears and hear not."

For the readers' information, we would offer, in explanation of our last article on the traveling engineer, that, at the present time in our section of the country, the master mechanics who keep the best class of machinery in suitable repair are those who highly value the services of competent traveling engineers. Such talent naturally works for *pay*, and *paying* results.

Your readers will readily understand that these views were mainly expressed with regard to railroad systems embracing several hundred or thousand miles, and having in service at least 50 locomotives to a division, or in the neighborhood of 500 locomotives to a system.

We owe the readers an apology for not having used a microscope in discovering such a vast title enshrouding the magnificent H., E. & W. T. and S. & H. railway system.

We recognize the fact that in all nature there exists a diversity of talent, and varying degrees of intuition and animal sense.

The finely strung nervous system of Bishop, the mind reader, has been experienced, and by the merely delicate intuition of his nerves, he could comprehend the feelings and transmute the thoughts of a fellow-being into vocal sound.

From this exalted type of the comprehensible being, we can look down the ladder, and note the fine gradations of animal power, until we find at the base the dense type of organism, void of perceptive power beyond the routine of selfish occupation, viz., 190 miles of narrow gauge road, with 16 locomotives and 570 cars—everything in shipshape, and resting on the shoulders of the magnificent and talented superintendent of motive power and machinery. J. E. PHELAN.

Dickinson, D. T.

[The editor took upon himself the responsibility of giving a title to Mr. Campbell's article, and to tying his title to his name.]

The True History of the "Neversink."

Editor The Locomotive Engineer:

In this month's number of THE LOCOMOTIVE ENGINEER there is an inquiry about the exploded engine "Neversink." About 1840, Baldwin built an engine by that name for the Philadelphia & Reading R. R. Co.; she was a single driver engine, and weighed about 13 tons gross; was made famous by hauling two car loads of passengers—about 60 people—up the old "Inclined Plane" on the "State road" at Philadelphia—was handled by Bill Petit, mechanical draftsman for Baldwin at the time. She was rebuilt by the P. & R. into a 6-wheel connection engine—weight about 18 tons—14½x20 inch cylinders, 46-inch wheel, after drawings by Predgold, of England, cylinders were on the smoke-box above the frame. Guides were set at an angle of about 25°. She blew up on a Saturday night in June, 1845 or 1846, on Mill Creek bridge, about 9 miles above Philadelphia, on the P. & R. R. R., killing the engineer, Bill Sullenberger, together with the fireman, conductor and front brakeman; being the fourth locomotive engine that had blown up in the railroad world up to that time.

This *may* be the engine to which you refer, as at that time the only sun pictures were the daguerreotypes

E. J. RAUCH.

A Spring Removing Kink.

Editor The Locomotive Engineer:

Herewith I send a sketch of an arrangement for removing driving springs on light engines, which we find very handy.

It is used by blocking up one end of equalizer in the usual way (we use a small screw-jack here) then put bar through loop and the end in hanger, pull down and remove key.

We use it on springs of 9, 10, 11, 12 plate, with from ¾" to 1¼" draw, and save a great deal of time over the old chains.

Boston, Mass. E. H. WALTEN.

"Looking Backward."

Editor The Locomotive Engineer

"He stole that," I suppose you will say, as you open this letter; but young fellow, I used it before the man who pinned it to his book was born, and besides that, if I want to say "looking backward," I am going to say it. I did commence this little piece "Glimmering Rearwards," but scratched it out, as being too giddy for a man of my years.

I laid off this trip, Mr. Editor, to be home on the occasion of the anniversary of the first half century of my life's run.

If I keep on thinking, and talking, and breathing till 8:41 and a half, I will be 50 years of age—mileposts seem to be getting closer together, somehow.

As I sat before the open fire just now, when it was getting dark around the edge of this great big world, my mind's eye was "looking backward," over those 50 momentous years, and I was thinking that, if the measure of a man's years can be figured by what is done in those years—the progress that is made—that old man Methuselah, was a very young pup, compared with a grizzly dog of my days, getting along in the sere and yellow leaf.

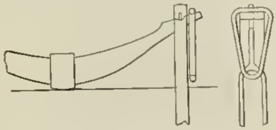
I haven't done a thing all day but talk over the old times with Mrs. A., and "look backwards," but she—Mrs. A.—has been busy. Women think at work, men make a business of it. Even now, with all the work done up, and her chair drawn up into the little family circle, she is quietly darning something. And as I "look backward" over the years that she and I have been together, I feel ashamed to think that she has done the most, said the most, been seen the least, and got the least credit. She has not been my partner, except in the sense of a silent partner. She lost her own name and identity the first move; she is Mrs John Alexander; the mail all comes addressed to me, the door plate has my name on it, and the children are all branded Alexander, as plain as the nose on your face

I was just trying to find a railroad comparison to a good wife, but I can't. The best I can think of, is a tug. A switch engine would not be fair, switch engines do lots of work, but, my, they make a fuss about it. I have known, afore now, a modest looking three legged switch engine to shackle onto a row of cars, and start out past the passenger depot, like a road engine bound for St Louis or Omaha, and shouting, "Watch me!" "watch me!" "watch me!" and then go to the far end of the yard, and throw the load into the back track, when you wasn't looking, and commence pottering around, pretending to be awful busy; but pshaw, that is not the good wife—it's the hired girl. Mr Editor, did you ever go down to the Battery, in that gigantic Sodom of yours, and notice a great ship come up to the wharf? Grand, ain't it? The great monster ship, with the scars of the storm battles upon it, laden with the freight of far-off climes, glides up the quiet waters of the bay—against the ebb tide. Flags flying, sails furled, not a sign of life or power; no smoke, no noise, but steadily coming up stream. The people look at the ship, and praise its lines and staunchness, and gigantic size and power to go on long trips, but mighty few inquire what is making it travel so steadily and so surely to its place at home. Go around to the other side, and there we see a little tug, lashed fast to the great monster's side, out of sight behind its greater bulk, and guiding and forcing it in the proper channel—the ship's wife.

I never knew a ship to take a tug, unless it expected the tug was going to do it some good, and I never knew a tug to tie up to a ship unless it was convinced and confident that it could handle and be of a good deal of use to that ship—that's marriage.

Of course when the tug is first lashed fast to the big monster, she commences to push or pull, trying to get the ship to go the way *she* wants it to, and then she kicks up some foam and makes a fuss, exhausting into the air, and blowing off—that's a honeymoon spat.

But just the minute the ship commences to come *her* way, down comes the pop, "biff," the exhaust is silent in its own condenser, but the little tug is digging her toe nails in, and doing more work than ever—just like a good wife.



SPRING REMOVER KINK

My advice to every old hulk of a railroader who is trying to make port with a load of sand ballast against a head wind, with the rudder tangled up among the boulders on the bottom, is to put up signals for a tug—only be sure you don't throw a line to a canal boat or a scow.

I look around on my little circle with satisfaction and pride, yet "looking backward" but a little into the years that are now but history, there was another little face in the circle—a baby's face. She came to us like a tender little offering upon the altar of our home love, out of the mysterious bounty of the Goddess Mother, Nature, she came; back into that mystery she has gone again, leaving in our hearts a tender sorrow, and a deeper love. Like the frost ferns upon the pane, like the little Alpine flower that blooms amid the eternal snows of the everlasting peaks, beautiful as a dream, and tender and delicate as a mother's love, there is no transplanting, no plucking without destruction. She came, and went away again. She was, and is not. Like the remembered vision of a beauteous scene; like the echoing cadence of a passionate song, she has become to our hearts a sacred, holy memory

And my friends, my comrades, those who started out with me to fight the battle of life—what of them? "Looking backward" through the vista of the years, I have counted them one by one. Ah, how they are scattered. Some are driving their iron steeds among the crags and snows of the Andes and the Rockys. Some swelter beside their giant hogs in the deserts and the plains. One is at the bottom of the deep blue sea. Two—and beardless boys they were—sleep beneath the withered flowers yearly strewn upon the soldiers' grave. Some are on the old road, some here, some there, but the great majority have come in—like the wrecks they made—dead.

Some, simply silent and beautiful, with the fires of life extinct, have been towed in; but most of them have come as dismantled and battered hulks of their former greatness and power, and all have gone over the silent river Styx, to that great shop, where all the victims of the lap orders and misplaced switches on the road of life go in—but from which none are returned to their old work, and their old runs

Now, I was going to get you to "looking backward" to the best railroad story you ever heard me tell, but you have said, "Bile 'em down to two columns or less," so I will just stop right here, and say "To be continued in our next."

JOHN ALEXANDER.

How to Run Very Soon After Firing.

The old-timer came in again Saturday, and sitting down in the holy of holies, he spit at the editor's feet in mistake for the spittoon, and opened out.

"That reminds me of old Davie Upton. Davie was master mechanic of the old Cheshire road, way back in the 40's, and afterward on the Central, out at Rochester

"Davie had a fatherly way of talking to his men, everybody was Sonny.

"One day, way back in early war times, a young feller came into Davie's office and struck him for a job.

"'What did you want to do, Sonny?' asked Davie.

"'Well,' said the boy, 'I'd like to get on firing for a while, then go running.'

"'Yes, yes,' said Davie, sorter to hisself; 'I'll tell ye what you'd better do, Sonny, you'd better enlist and go to war, then you could fire and run, too.'"

A great deal of complaint comes from men running the fast trains, with new 12-wheeled cars, about the poor holding power of the brakes You must remember that the brakes only apply to eight wheels, and the total braking force is thus cut down Take a drawing-room car weighing 81,000 pounds, with 8 wheels braked a total braking power of but 45,000 pounds can be used, while with a shoe on all the wheels under the car, a total braking force of 72,000 is available. A train of these cars, drawn by an engine without a driver brake, needs a great deal more room to stop in than one with modern equipment

Slowly but surely the federation of the engine and trainmen of the country is going on, the union is being effected without noise or smoke, and its thoroughness is little known or understood That Reason shall be elected permanent president, Common Sense, secretary, and the Golden Rule adopted as the constitution and by-laws, we sincerely hope That such an organization will be powerful there is not the least doubt, and, as long as that power is used to aid members of the organization because of the *right*, and not because of the *might*, no one can complain—and no just man will.

Miss Nell Nelson has had a ride on a locomotive from New York to Philadelphia, and if all she says in the N Y *World* is true, the boys were not very careful of her "Perched up between the *steam chest* and the cab" is rather an airy perch The *copper* boiler also disturbed her. We hardly expected a woman to see things right, but was not prepared to hear her misrepresent the kindly engineer, who is alleged to have referred to his pet engine as "he" and "him." A real, live engineer would as soon think of calling his wife "Mr." or his mother "it."

Something of the way the old "Monster," illustrated on the first pages of this paper, looks to a person not on the road, may be gathered from the remark made by the wife of a P R. R official, on seeing a picture of one in his office: "Why, John, this engine was in an awful wreck, wasn't she?"

The *Railroad Brakeman's Journal* has been changed to the *Railroad Trainmen's Journal*, the name of the order it is the official organ of having been also changed. When changes improve we believe in changing—this is an improvement

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS

Traveling Engineers.

There seems to be a wholesome difference of opinion among prominent railroad men, as to the use of traveling engineers, or road foremen of engines.

On great systems, where the superintendent of machinery must have a number of master mechanics in charge of distant districts of the road, we cannot see why the road foreman of engines is not a great help—acting as an assistant to his superior officer, and representing him away from the home office. The traveling engineer should be above the division master mechanic in rank, or be a division officer under him—not two men of the same rank contending with each other.

The selection of traveling engineer is a point that is given too little attention on most roads, where men are often selected for this place because they are the oldest runners, and as long as they live hold the office, although there may be several changes of their superior officers—fancy a man taking the place of another who has died or retired, and commencing to wear the dead man's spectacles, regardless of the fit.

Traveling engineers are a fashion—they come and go—if a big road has one, the little road appoints a bigger one. That they are of use to the service on some roads, and under some conditions, and of no use under other and wholly different conditions, there is little doubt.

But the followers of the different disciples are well able to argue their case, and are invited to do so. But, try to avoid personalities.

Horatio Allen.

America's First Locomotive Engineer.

At the head of this article will be found a portrait of a man whose name should be familiar to every engineman in America, for it was he who first opened a throttle and moved a locomotive on the western hemisphere. Mr. Allen was born in Schenectady, N. Y., May 10, 1802, and died at his home at Orange, N. J., on the last day of 1889. Mr. Allen was educated for a civil engineer, and surveyed the first road built by the Delaware & Hudson Canal Co., at Honesdale, Pa.

Hearing of the success of George Stephenson's locomotives in England, he resigned to go there to investigate, and on the eve of his departure was commissioned to purchase the rails for the D. & H. C. Co.'s sixteen miles of road, and to buy three locomotives. He returned with three locomotives, two of Stephenson's and one of Foster, Rastrick & Co.'s. This locomotive, the "Stourbridge Lion," was destined to be the first to run in America.

There were no engineers then, everybody was afraid of the little seven-ton machine, everybody said it wouldn't go around the curve, and everything else.

Steam was first raised on August 9, 1829, and Mr. Allen himself took his stand on the footboard, and said:

"If there is any danger in this ride, it is not necessary that the life and limbs of more than one should be subjected to that danger."

He was going to see his machine through. Mr. Allen had never run a locomotive or other steam engine—and never did afterward—but the light engine was then and there run out, around the curve, and into the woods of Pennsylvania, three miles, and returned to the place of starting, without mishap.

That was all the running the "Stourbridge Lion" or her engineer ever done. She was decided to be too heavy for the track, was laid up for years under a shed, and finally sold for stationary purposes. Her boiler and one cylinder—as they now are—were illustrated and described in this paper for September, 1888. Mr. Allen was identified for some years with the engineering departments of several of the early roads, and was for many years at the head of the Novelty Works in this city. For some years he has lived in quiet retirement at his place near Orange. A few months more than sixty years passed before the first American locomotive engineer lost sight of the progress he inaugurated. In that time he saw the roads of his country grow from 16 miles to more than 160,000 miles, from one locomotive to more than 30,000. Saw the invested capital of the industry reach more than $9,000,000,000, and the army of employes reach over 1,000,000. The day he stepped off the footboard of the "Stourbridge Lion" he was the only man in America who could, by the wildest stretch of imagination, be called an engineman; he lived to see their number increase to 70,000. Horatio Allen ought to be remembered as the father of locomotive engineers in this country. We reproduce this portrait from *The American Railway*, a most excellent book, published by Chas. Scribner's Son's.

Following the Leader.

For some reason best known to themselves, a flock of sheep will follow anywhere a bellwether will lead—even into a lake—but that is no reason why sane human beings should do so—unless we confess that they have no more brains than the average head of mutton—which we do not.

Wherever we look back into the history of the human race we find little or no progress where the people simply followed leaders; progress has always been made where people ignored their leaders and did a little thinking and judging for themselves. The high priests of many a nation have kept its people in bondage simply because the people have blindly accepted what the priests have said, without bothering themselves whether their teachings were correct, and for their own good.

What was all right for the ancients will not do for us—if it would, we would be wearing breech-clouts instead of coats, pants and vests. Every thing has changed, even religion has been modified a great deal to adapt it to the wants of this age; but still we find plenty of laboring men who have set up in their hearts leader idols, and they blindly accept what they say as the law and gospel.

One man believes in a certain party, he is a politician of the regular ward school; whatever the party leader or the party organ does or says is *so* with him; it's simply so, no ifs nor ands about it—this is following the leader.

Here is another man that follows the same line of reasoning in regard to business transactions, in religion, in love and marriage, or—in worst of all—labor orders, here is where there is more blind leader worship than in any other place.

We do not object to men loving and honoring their brainy men or those who represent them before the public, nor to the maintenance of these men of brains in exalted positions; we object to such as worship their acts without knowing anything about the acts, and to the leaders who think that the way to lead is to force the rank and file to believe and do as they do.

The safety of the people, of labor organizations, of churches, of nations, lays in the masses thinking about the questions of the hour—especially true of labor organizations.

Then the man who pretends to lead his fellows by organizing a great body guard that come and go at his beck and call, who applaud his acts and shout down and denounce those who, by word, or deed, differ from him, is no leader at all. He is a curse, a false idol.

The true leader of laboring men will not try to have the members of his order do as he does, or think as he thinks; that is not his mission, and he knows it. His whole aim is to induce the individual members of his order to think for themselves, to debate each and every topic that comes up in the affairs of the order. His is an arduous task, and he spends no time in seeking a re-election. He knows full well that it is the average intelligence of the members that will keep him and his order off the rocks, so he simply does and says things to make his men think and study the problems for themselves, he is careful to express no decided opinion on a new and complex subject until he has put the case before his constituents and heard it discussed, then he gets a consensus of opinion that is far safer for him to follow than an idea of his own, perhaps biased in some way almost unknown to himself.

Always bear both sides of any case before deciding anything about it, then go quietly off by yourself and forget who or what you are. Put yourself in the place of the parties on both sides, look at the subject from every point of view, and try and decide the case as you would wish it decided if you were in either place; if they differ, split the difference, come to some decision in the case as near fair as you are capable of deciding, and then express your convictions, regardless of who frowns or who smiles. Be honest, be just.

Have ideas and opinions of your own, but do not confound opinions with crotchets and hobbies; think, reason; forget the results to yourself, and think of the results to the majority of your fellows—what is the best for the majority is usually a good thing to have—even though it hurts some one.

When you find a man who goes to the front, and is counted a leader, see if he seeks to enlighten, if he reasons with his fellows, if he seeks their aid and council, if he presents arguments instead of statements, if he denounces no one who differs with him. If he is this kind of a man he is safe enough to follow, for he simply calls your attention to an important subject, gives you his reasons, and leaves you thinking on the subject—he has done good, if it never again comes up.

If, on the other hand he simply announces so and so, if he pats all those who are with him, and slaps at those who differ, he is the leader, *not* to follow. He is sure to jump into oblivion some day—don't be too close behind.

Read books, hear lectures, sermons and speeches, not to adopt or renounce the arguments or theories advanced, but to aid you in your research in the matter, to help you form some opinion of your own—to help you think.

The best labor leader in the world—and he never pretends to lead at all—is the man who *thinks*. He promotes discussion and argument, he educates, he builds on sure foundations, for he puts into the individual members of his followers the reasoning power; each is an intelligent factor, reasoning for himself; in a combination of such men there is little danger of the majority making very bad decisions in cases of trouble—every man is a leader.

The worst labor leader in the world—and he is a self-acknowleged one—is the leader who does all the thinking for his crowd; they are the force in his hands—he rules by force, he crushes the individual thinker with his frown, he usually rides rough-shod over opposition, nurses favorites, and rings of heelers. He is the brains—his followers the hands and feet. The combination won't work, it don't balance. Nature furnished one set of brains for every pair of hands and feet, and never intended that men should form themselves into associations, where one pair of hands kept still, and one brain worked, and a thousand other brains kept still, while four thousand feet and hands pawed gravel.

Get away from this leader—be a leader yourself. Don't get into any man's harness and let him drive you—ride.

We Move.

From far and near come the signs that locomotive enginemen are waking up to a recognition of the fact that there is room for improvement in themselves as enginemen. Discussion is rife, the lodge rooms are full of "engine talk," books are being purchased, models set up, and a gradual increase of self improvement is evident all over the country. It is time this came, and can but benefit all who take part. The greatest benefit will be to the companies employing these men, and they are the first to recognize it. Early this month we received a letter from a well-known master mechanic, headed, "Why is it that engineers and firemen are so afraid they will learn something?" Ten days later we got another letter from the same man, reading. "Hush, don't say a word; the engineers and firemen have started a debating club. What is the price of that valve motion model? If they last a month, we will give them one." Good deal in this; think about it.

An Awful Example.

Usually the best way to illustrate a natural law is to carry the case to extremes—sometimes it is a good way to show up unnatural laws. It is a well-known law that there is a greater pressure at the bottom of a glass of water than at the top, although we cannot always notice it; if we imagine a glass a hundred feet high filled with water we see at once that a hundred feet of water is loaded upon the bottom of the glass.

The rule of making a smoke-stack one inch larger in diameter than the cylinder loses its attractiveness when we imagine a cylinder one inch in diameter and a stack twice as large.

It is a well-known law in railroading that to let everything run down for the sake of paying dividends leads to ultimate ruin, but this law is so well known and generally recognized that there are very few railroad managers foolish enough to carry it to extremes. The following, from the press dispatches of January 26, shows just what can be done in this line, and is interesting reading—except when we come to the lists of men who have been murdered in the experiments:

"Twenty-three wrecks in three weeks have caused a wholesale discontinuance of passenger trains on the various roads that make up the system of the Central Railroad of Georgia, which is a part of the Richmond & West Point Terminal Company's system. This has developed the fact that this once splendid railroad is now in a most deplorable condition as regards its facilities for handling both freight and passenger business. Twelve important passenger trains have been discontinued, ten to-day and two last Sunday. This will make an aggregate reduction in passenger-train mileage per day of 1,500 miles. Various reasons have been given, and the truth is that trains have been taken off simply because so many engines and cars have been broken up recently in wrecks due to the bad condition that these roads have been allowed to sink into that there are not enough left to make up the trains. Major Cecil Gabbett, General Manager of the Central of Georgia for about four months, admits that the system is in very bad condition.

A resident of this city who is very close to Mr. Gabbett, in discussing the situation last night, said: "There are not enough engines and coaches left to keep up the trains. Wreck follows wreck in quick succession, and the road is becoming more and more helpless every day. The newspapers contain accounts of frightful accidents somewhere on these roads nearly every day. Yesterday a collision between two freight trains occurred at Camp Hill, Ala., and five men were killed and two engines and many cars were demolished. This is the twenty-third wreck on this road in three weeks. I have before me newspaper accounts of nine wrecks of freight trains that have occurred in the last eight days on three of the Central's lines running into this city in which lives were lost, ten men were wounded, eight engines were torn up, forty to fifty cars were broken up, and many thousands of dollars' worth of freight destroyed. When Supt. Haylow was notified of the wreck at Camp Hill yesterday he did not have an engine to carry him to the scene of the disaster, although this is the center of his division and the terminus of five of his roads He had to wait some hours for an engine to come in before he could start. The company's shops are full of broken engines, and its yards abound in wrecked cars. It is stated that an expenditure of nearly $2,000,000 in repairing the roads, and the bridges and trestles, and in the purchase of engines, coaches and cars will be necessary to put the Central in position to handle its business satisfactorily. It has apparently been the policy to make the Central show large earnings and small operating expenses, without regard to the maintenance of the roads in proper condition. This is the result. So many men have been killed and wounded of late that it has become necessary to employ two traveling adjusters for the settlement of damages for personal injuries alone."

The Westinghouse Air brake Company report their total American equipment as follows; "The Westinghouse automatic brake is now in use on 20,000 engines and 200,000 cars This includes 100,000 freight cars, which is 10 per cent. of the entire freight car equipment of this country. Orders have been received for 50,000 of the improved quick-action freight brakes since December, 1887."

Books Received.

GIBBS' ROUTE AND REFERENCE BOOK OF THE U S AND CANADA FOR TRAVELERS Gibbs Bros & Moran publishers, 57 Rose street, New York.

This is one of the neatest, most complete and comprehensive books for reference of travelers we have ever seen.

The usual railroad guide is an enigma to all save a few of the initiated—specially true of ladies. There is too much of them.

This work has maps of each State and province The most direct routes of the railroads are shown by heavy lines, possible routes by dotted lines. Between all principal towns a light faced figure tells the distance, a heavy-faced figure the fare in dollars and cents. Thus, by simply looking at the maps, the distance and fare can be seen at a glance There are tables that show where connections can be made; and, for the use of commercial men, tables of different business houses, and how many of each in the towns shown on the maps A list of the hotels is also shown

ASKED & ANSWERED.

(5) J. B., Jr., Fireman, Brooklyn, asks:

Where is the *Locomotive Firemen's Magazine* published? *A*—Terre Haute, Ind.; and every fireman should read it.

(6) H. C., Buffalo, N Y, asks

Why are cylinders placed above the center line of the axles? *A*—On small-wheeled engines this is often done to get cylinders up out of snow and dirt; but most cylinders are raised so that, when engine rolls, the center line of axle will not come above center of cylinders.

(7) C. B., Baraboo, Wis., writes. I heard a dispute between two experienced engineers in regard to lead on valve motion, one claiming that lead increases the more the lever is hooked up, the other denying it, stating there is no more lead hooked in 6" than at full stroke. Which is right? If lead is increasing by shorter cut-off, how much will it be at 6" if there is 1/16" at full stroke? *A*—With the ordinary shifting link the lead increases as the engine is hooked up (see article on page 5, February, 1889). Radial gears, such as the Walschaert gear, have a fixed lead, the same at all points of cut-off An ordinary link motion, having one-tenth of an inch lead in the corner, the lead will increase to from a quarter to three eighths at a six-inch cut-off.

(8) Young Machinist, Oil City, Pa., writes:

Being a young machinist and subscriber to your worthy paper, I would like you to tell me through your paper why the right main pin, or main rod pin, when engine is going ahead, lead the opposite or left side To illustrate, suppose the right-hand main pin is on forward dead center, the left hand pin is on upper quarter. What difference would it make if all the crank-pins on left hand side were on the lower quarter—would it make any difference, or is it just a standard locomotive builders have adopted, irrespective of cause and effect? *A* It makes no difference in the working of the locomotive, whether the engines are right or left-hand leads, but the right is now universally used, because all quartering machines are right handed ones

(9) P. M New York, asks

1. Why does the eccentric, which controls the valve, always follow the crank in an indirect engine, and lead the crank in a direct engine? 2. Why will a pin run hot one way and cold in the opposite direction? 3. Why will a guide run O. K one way and black in the opposite direction? *A*—1 Because in the indirect engine it is necessary for the eccentric to *push* the lower arm of rocker *ahead* to draw the valve *back* and pull it *back* to push the valve *ahead*. The direct engine has no rocker, and the eccentric leads the pin, to be in position to move the valve direct 2 It has long been noted, that almost any machinery that has long run in one direction, will heat if run in the opposite, and the cause is thought to be because of the roughing up of the molecules of the journals and boxes. Probably local changes are the cause as a rule. 3. When a locomotive is running ahead, the tendency of the cross head is to push *up*, both in the forward and backward stroke, while in backing up the tendency is to force it *down*

(10) B. Liner, Indianapolis, writes.

We recently cut up some very old locomotives, with cylinders placed well up on the smoke arch, and inclined more than any I ever saw, these engines had 3/16ths of an inch clearance; the men working with me say it was on account of the poor workmanship of the times, and because mechanics then worked to 8th of an inch measurements, instead of 100ths and 1,000ths, as now I am inclined to think there was a reason. Can you help an apprentice boy, by stating what it was, if there was one? *A*—The clearance was given on account of the incline of the cylinders If the main driving box moves up or down, as it passes the center, of a locomotive having a cylinder on a level with the driver center, it can but increase the angularity of the rod, and bring the piston back in the cylinder, but, as the possible movement of the box is but 2½ to 3 inches, this can affect the piston but little. Suppose now we carry the matter to extremes: put the cylinder vertical, directly *over* the driver, the clearance would have to be increased to the full movement of the box, and this clearance can be decreased as the cylinders are placed nearer a horizontal line. The more incline, the more clearance is necessary.

Some Fire-Box Devices to Aid Combustion.

The illustrations on this and the next page show the plan used by Mr. Cushing on the U. P. to improve the combustion in locomotive fire boxes. Fig. 1 is a side view of the box, showing the manner of holding the brick arch, and the arrangement of the steam and air jet apparatus at the front and back.

There have been in use for many years, on different roads, devices for admitting air over the fire, the commonest kind being simply hollow stay-bolts. While these have had their friends and their enemies, there is little doubt that the circumstances under which they were used made all the difference in the world about their success or failure. Where deep fire-boxes and deep fires are in vogue, as well as coal that crumbles or clinkers, the hollow stay may have been a good thing; on another engine with a shallow fire box and a shallow fire of good lump coal, they may have done more harm than good; most of us that have fired and run engines, know from experience that admitting air over the fire by partially opening the door will generally prevent, or abate in a great measure the rolling of black smoke.

The next step after the hollow stay was the steam jet over the fire; this prevented smoke in a measure, and would sometimes do more in that direction than air. Then came the steam jet that was surrounded with an air inlet, something on the plan of the Bunsen burner, the central jet of steam drawing in a large volume of atmospheric air and mingling it with the gases in the furnace; this was a combination that sometimes worked where neither the steam nor the air would alone, but as often failed.

Mr. Cushing's device is a combination of all the schemes mentioned; his jets are made like Fig. 2; the steam from a half-inch pipe is led to the cock and is coupled to an elbow that terminates in a jet, as shown, the flow of steam being regulated by a globe valve in the cab. The frame or body of the device has openings around the outer end, and an internal plug with openings to correspond to those in the body of the device, the plug is turned by a handle, as shown, that is connected to a rod, so that all the cocks on the end of a fire-box can be controlled at once and always alike. Now with this arrangement steam alone can be used by closing the air cocks; air alone can be used by opening the air-cocks and shutting off the steam, or the air and steam can be mingled in any desired proportions to suit the coal, the design of the furnace, or the ideas of the men handling it.

Fig. 1 shows the arrangement of the operating handles, both being controlled from the left side of the cab. Of the device, Mr. Cushing says.

"I put on four gates, as per sample, on front end of fire-box, and four back. On our standard eight-wheel engines we are locating air-gates as shown on print, however, their location can be modified to suit depth of water leg, etc. I get the best results by having the front gates just high enough to be about two to six inches above top of fire when it is at its maximum thickness, and back gates do well set about four or five inches, or about one row of stay-bolts, higher. This, I find, helps the admixture of the gases better than when set on the same line. Opposite each air gate, tubes are inserted in water leg. I am putting those in here of 1½" lap-welded steam pipe. I find it answers very well. It is something we carry in stock for our Baker heaters. After 1½" tubes are put in and air gates fastened in position, we then connect steam pipe. This steam pipe as shown is ½ from boiler, but where it branches off to front and back gates, it is reduced to ⅜". Front cocks are operated by bell crank and handle *D*, back cocks by handle *E*. By the use of these handles, atmospheric air can be excluded or admitted, by the use of the globe valve, steam can be used through all gates, or shut off, as desired. When it is desired to entirely prevent throwing black smoke, the admission of both steam and air at same time gives best results. With the use of Iowa coal we scarcely ever find it necessary to close cocks from atmosphere, but leave them open, or partially so, as desired. When used in this manner they serve the same purpose as a hollow stay-bolt, with the advantage that supply of air can be regulated or entirely cut off if necessary. Steam can be used at depots, or in cities, or at any point to obviate black smoke, and, in conjunction with the atmospheric air, will be found to greatly aid combustion."

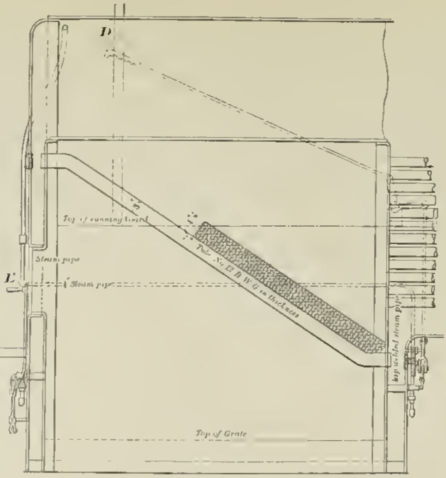


Fig. 1

Fig. 3 shows the arrangement of the jets on the front of the fire-box, looking back, showing the arrangement of the lever for the front; the back lever *E*, Fig. 1, simply coming up above the deck on the left side near the fire-door.

The large brick arch is supported on three 3" water tubes, that run from the lower part of tube sheet to the back of fire-box over the door; wash-out plugs are arranged at both ends of the tubes to keep them free of deposit. Four-inch brick are used, the lower one being made as shown in Fig. 4, an opening being provided at the bottom to prevent collection of coal or cinders on top of the arch.

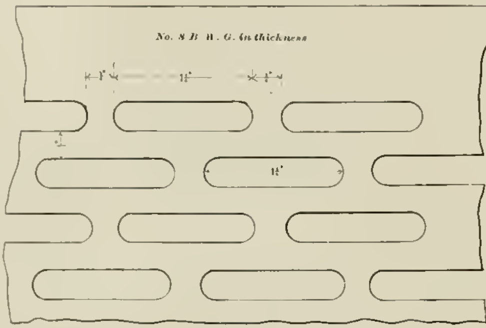


Fig. 3.

(*See page* 25).

The plan of placing brick arches on water tubes is far superior to the one of resting the edges on studs in the side sheets, and letting the weight of the brick keep them together in the center of the arch, as with the loose brick there is no danger of knocking the arch down with coal or fire tools, and it is easily removed to allow inspection and repair.

Large hand-hole plates are, as a usual thing, oval, and the plate on the inside of the boiler held in place by a central bolt and a bridge. On the U. P. they use a very strong device that requires no gasket, has a ground joint and is held to the seat by direct pressure over the joint, as shown in Fig. 5. Three studs serve to hold the outside plate against the plate proper, which has a ball joint; the central stem simply serves to hold the plate when it is being put up, the pressure being directly over the ball joint.

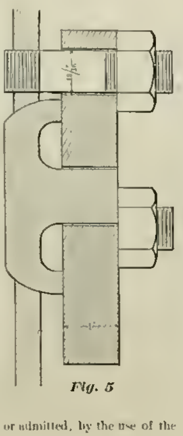


Fig. 5

Boston Shops of the Fitchburg Road.

On a recent tramp through New England the writer spent a couple of hours in the shops of the Fitchburg road at Boston, or rather Charlestown, but a stranger never knows when he is out of one and into the other, unless he asks a policeman. These shops are located close to the river, in fact, on the very bank; they are old, and were originally built when the road had but twenty-five locomotives, and are now used to keep up nearly 200.

The machine shop and erecting shop is a long building, the engines being rebuilt on long tracks, no separate pits being used, there were 12 or 14 undergoing repairs at the time of our visit. The machinery is mostly old, but has received fair care; but, where all kinds of work are done in one room, it is impossible to keep tools clean. The road owns many different classes of engines, from many makers. We noticed some consolidations having the links ahead of the rocker, with a connection back of it.

A number of Taunton engines in the shop were receiving new jackets; these engines were lagged with asbestos mortar, and the jackets had been put on before the mortar was dry, the Russian iron was eaten full of holes and was very rotten, but had been in service but a couple of years.

On some of the consolidation engines where the spring hangers had cut the frames, the trouble was cured by making the hangers stiffer, it was the springing of the hanger that allowed every little movement of the box to throw it against the frame.

Mr. Stewart is improving the convenience of many of his passenger engines by placing the air-pump below the running board, so as not to obstruct the view of the engineer, and in putting the engineer's brake valve on the side of cab, in front of him. Just why the brake valve should be on the boiler-head, no one knows, when on the side of the cab it is where a man can reach it when looking out of the cab window, it does not get hot, takes less pipe, and is easier cleaned. On engines where the boiler comes through the cab, this reform is especially necessary. On this road, cast-iron links are used with good success.

Double nozzles are used, but they are but half round, and the pair look like a single nozzle with a bridge in it. Mr. Stewart recently made some exhaustive tests with stacks, and believes he has improved the steaming of his engines by putting in an interior pipe, tapering from a point about a foot above the base, where it is the smallest, to the top. Freight engines have diamond stacks with cast top.

Some of the boilers in the shop are having the fire-door raised about ten inches; were too low to keep fire on the grates behind.

On this road, every engine is equipped with the Ashton blow-back, safety valve, the steam blowing off into the tank. Mr. Stewart uses them as a check on careless firing. It is a dischargeable offense to let the water get too hot to work through the injectors. The roundhouse is very old, entirely under cover, table and all, dark, and impossible to heat properly. A new blacksmith shop has recently been built, and the old shop room added to the main shop.

Many of the Manchester engines have lugs on the sides of the four-bar guides, in the center, and a post between them, held by a central bolt; this makes a stiff guide, and makes a brace of the lower guide for the top one.

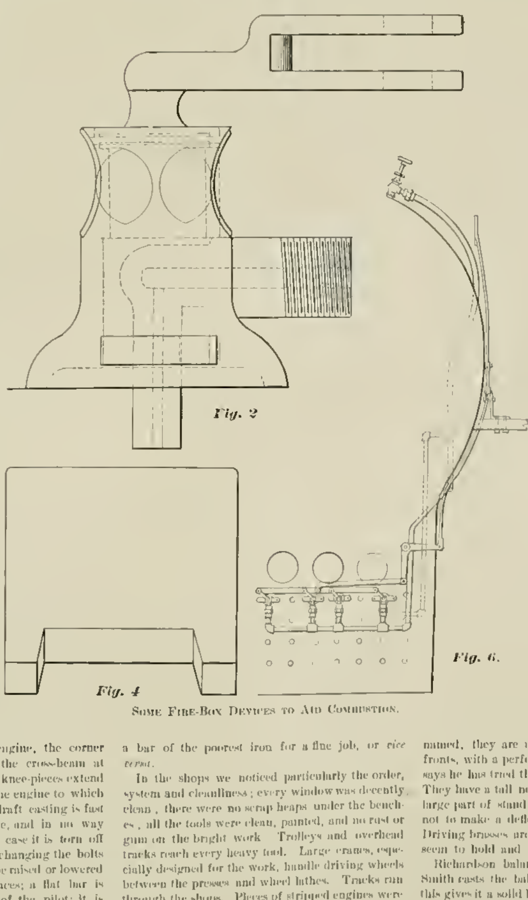
They have the best arranged wooden pilots we have ever seen, for convenience in taking off or putting on, and one that allows of the use of one sized pilot for all heights of engine, the corner posts of the pilot extend above the cross-beam at top, to which the slots are fixed, knee-pieces extend down from the buffer beam of the engine to which the corner posts are bolted; the draft casting is fast to the buffer beam of the engine, and in no way connected to the pilot, so that in case it is torn off it does not break the pilot. By changing the bolts in the corner posts the pilot can be raised or lowered without disturbing the heel braces; a flat bar is used here to support the nose of the pilot; it is bolted to the nose, but has a slot in the other end, that enters the cast draw head in front and is held there by the pin that holds the coupling bar. This brace is flat, lays under the draw bar, holds just as much as truss rods, and is easier to get off.

Our friend and correspondent, W. de Sanno, has removed from California to his old home at Corry, Penn. He will be heard from in a new field at an early day.

In the Boston and Maine Shops.

Last month the writer spent a very pleasant and instructive half hour in the Boston shops of the B. & M. road, which are under the charge of Wm. Smith, superintendent of motive power.

This is the best shop we have seen in the East; it is located on the river bank, in a crowded portion of Charleston, but the buildings are well kept, many of them new, painted and clean. On a rack in a little material yard, but under cover and beside the smith shop door, were piled the different sizes and shapes of iron and steel bars, used for all purposes. We observed that the ends of the bars were painted in several different colors. A board with all the colors on it, nailed to a post, tells what *quality* or kind of metal the colors represent. Different brands of steel, used for totally different purposes, are thus kept separate, no matter how long in stock, and there is no excuse for a man taking a bar of the poorest iron for a fine job, or *vice versa*.



SOME FIRE-BOX DEVICES TO AID COMBUSTION.

In the shops we noticed particularly the order, system and cleanliness; every window was decently clean, there were no scrap heaps under the benches, all the tools were clean, painted, and no rust or gum on the bright work. Trolleys and overhead tracks reach every heavy tool. Large cranes, especially designed for the work, handle driving wheels between the presses and wheel lathes. Tracks run through the shops. Pieces of stripped engines were piled orderly, by themselves, near the tools that must work on them.

While Mr. Smith was giving some man some instructions, we asked a latheman how it come that he had so many new tools. He answered:

"Well, we had a fire a few years ago that got rid of everything, but Bill (Mr Smith) won't have anything but the latest and best. If a man or a machine gets behind the times you can bet he sets them out quick."

That tells the whole story.

The erecting shop is an enclosed roundhouse, turntable in the center, and a high tower over it; the engines are backed off the table. This plan gives room enough to keep all the stripped parts, on which there will be no work, close to the engine, and prevents unnecessary handling, facilitates getting around, and prevents men from getting in each other's way.

Between many of the pits, machines are running, and the system of arranging shafting around a roundhouse is interesting. This is done by running a shaft from the main shop into the erecting house nearly to the table; from this a belt runs, at right angles, to a shaft more than half-way to the wall. This second shaft carries a pulley at its far end that belts back to another shaft, and so they zigzag around the house; yet the shafts are all paralleled to one another, as the belts are also paralleled to each other.

The lighter class of work is done up-stairs, and here is located one of the best equipped tool-rooms in the country. It is very large and well supplied with almost everything one could wish to see in such a place. In a room adjoining the tool-room there are any quantity of templets stored. We could not but help noticing the extra care taken with these templets. Every hole that must be used to lay off work is bushed with a hardened steel bush; and templets are used for every conceivable purpose. Any pilots on the road can be changed to other engines without boring new holes; they are all alike, even the headlights are bolted to the bracket board through holes bored to templets—any one will go where any other one will.

The tool-room keeper has every convenience, dumb waiters supply tools to the lower shop, men are not allowed to come up stairs to ask for them, nor go to the blacksmith to get tools dressed. The foremen all have desks and individual wash sinks, wear white shirts and—are foremen.

Sinks for washing, hot and cold water, clothing closets, and all the latest and best conveniences are provided for the men.

There is a separate room where the Westinghouse brake work is done, and we noticed throughout the shop a tendency to keep the same men on the same kind of work.

The engines are well kept—clean, nicely painted, and all manned, they are mostly eight-wheelers, extension fronts, with a perfectly straight stack. Mr. Smith says he has tried the taper stack to his satisfaction. They have a tall nozzle stand, single nozzle. The large part of stand is flattened in the center so as not to make a deflector of it in front of the flues. Driving brasses are in three pieces, driven in, and seem to hold and wear all right.

Richardson balanced valves are used, but Mr. Smith casts the balance plate solid with the cover, this gives it a solid bearing, when he wants to lower the plate he dresses off the joint on cover, which is left thick for this purpose.

It was here that the machine was invented for turning up pins cast solid in crossheads by a geared tool-holder passing around the pin. The original machine, made many years ago, was lost in the fire, but a copy of it is here and at work, it is not so handy a tool as the one built by Pedrick & Ayer now, but it does good work.

Mr. Smith has discarded solid rods, and takes extra pains with those in use, which are the strap and half-brass style. They use painted canvas on the roofs of cabs, and find it last longer than tin.

In the office the same order prevails, the clerks and time-keepers are separated from superintendent of motive power and his secretary, and all the little details do not annoy him. Mr Smith has a cordial way of steering newspaper fiends all through his place and showing up all that is of interest, taking them into his office, setting up the *Flor de Connecticut*, and saying:

"Now I have got just *one* favor to ask of you."

Of course, the newspaper man is anxious to do something in return, and promises—he came that on the writer, but we asked what it was.

"That you don't say one word in the paper about what you have seen here."

All we have to say on this subject is that any one who wants to carry out any joke like that on us has to spring it before we go through the shop. Like the man from Texas, we ask "What are we here for?"

The Staff System for Working Single Lines.

The *Railway Herald*, of London, has just paid one guinea as a prize for the following description of the "staff" system of running trains on single track lines in Great Britain. It was written by Mr. F G. Smith, Station Inspector, South Dock Station, Millwall Extension Line, Poplar, E

"If this article is not of interest to railway men, I hope it may be to the public who read the *Railway Herald*. That there are a great number who do not understand the working of the 'staff system,' I glean daily by the questions I am asked, especially by the seafaring portion of our passengers, as the following few examples will show. 'What's that thing for, governor, is that what they drive the engine with?' 'I say, old man, is that thing loaded? Mind it don't go off.' Or, 'I say, Mr. Inspector, what makes you change those "brass affairs," over for, they are both alike, aren't they?' Well, perhaps the train is approaching, so I have no time to explain the details of the working, so just say, 'It is for your safety, sir. It is a guarantee that two trains cannot approach one another on one section at one time, therefore making a collision impossible' 'Oh, yes,' he says, 'I see; thank you,' and away he goes. Yes, he may see, but in ninety nine cases out of a hundred he does not understand, nor can he be expected to, on such a brief explanation. I myself have never been sufficiently informed to speak with certainty as to the origin or invention of the 'staff system,' so will simply confine myself to a short description of the 'working,' believing at the time that it is no breach of confidence to my employers, as I have never been led to believe there is any secrecy in it, and I think it cannot be too generally known to the traveling public, the care a railway company takes for their safety. The branch line I assist in working consists of two sections, an 'up' and 'down' section, the trains passing one another on a loop line at an intermediate station, and from this loop line station I want you to understand I am working. There are two staffs—one staff for each section—and although perhaps alike to a casual observer, they are vastly different, one being round, and the other square. Each staff has engraved or marked on it the name of the staff station at each end of the section to which only it applies.

"Each staff is warded similar to an ordinary key, and keys they really are, as I will shortly explain. In connection with the staffs are iron boxes and paper tickets, printed and printed of a color corresponding to their own staff—not that this is necessary to prevent us making mistakes, it is merely a quick guide for us where there is more than one box, for understand, reader, the way in which the staffs are warded makes it impossible to unlock the wrong box. The tickets are called 'train staff tickets' Each ticket has the name of the journey for which only it is available printed plainly on it, and has to be filled in, that is 'timed, dated and signed,' by the person in charge of the station from whence it is issued. 'Each ticket is available for one journey only.' Now, in working with the staff alone, after delivering the staff of the section to be traveled on to the engine driver, he proceeds on his journey. You must naturally wait till he returns with the staff before you can send another train on that section, for the simple reason your boxes are locked, you cannot get a ticket, and there is but the one staff for the section. You say then, What are the tickets used for? They are used when two or more trains are wanted to follow on the same section. Thus, you wait till you get possession of the staff for the section to be traveled on, unlock the box, make out a ticket, and hand it to the engine driver, at the same time showing him the staff of section he is to travel on, and he proceeds on his journey. Immediately he gets to the station the ticket authorizes him to travel to, he hands the ticket to the person in charge of the station. His train is then shunted on to a siding to make room for the next incoming train. You will now see that, as a 'ticket train' cannot return, how impossible it is for two trains to approach one another on one section and cause a collision. I may add the used tickets are dealt with by the person to whom they have been handed, that is 'cancelled' and returned to the superintendent of the line. The person in charge of the station is held responsible for the proper working of the staff, the engine driver is responsible for getting the right staff for the section he is to travel on, the guard is also held responsible that he sees his driver has the right staff or ticket before starting his train. 'In all cases the ticket precedes the staff.'"

We know of no place in North America where the staff system is used, and the description of its working is therefore of interest.

"Put Yourself in His Place."

About the most fortunate people to be found are individuals who have enjoyed the felicity of getting shaken up or slightly hurt on railroads in or about New York, where courts and juries delight in giving damages. Cases which are really robberies are called justice in New York, because the parties stolen from are rich corporations. Three cases were decided in one day last month, giving heavy damages that never would have come into court had the defendants been private individuals. A jury before the Superior Court found a verdict for $1,500 in favor of Morris Quinlan, aged nine, against the Manhattan Elevated Railroad Company. A board fell from the track and struck him on the head, injuring his eyesight. David Mosseman recovered a verdict for $5,000 from a jury before Judge Allen in the Court of Common Pleas against the Metropolitan Elevated Railroad Company. A crowbar fell from the track and crushed his foot. Joshua F Page recovered a verdict for $15,000 from a jury before Judge Beach in the Supreme Court against the cities of New York and Brooklyn for injuries received from a collision of cars on the East River Bridge.—*National Car and Locomotive Builder*.

We fear our friend, in penning the above item, did so without hearing both sides, and "putting himself in the other fellow's place." The article seems, at least, to be the child of passion rather than of prudence.

It is far from our inclination to single out rich or poor to punish, by fines or otherwise, for misdemeanor or criminal carelessness, but the Elevated Company have a valuable franchise from the citizens of New York, affording them an elegant opportunity to make money—and drop boards and crowbars on people Heavy fines are, perhaps, the best preventative for carelessness, and they are therefore used.

The writer would not take the chances or sustain the injuries in any of these cases for the money paid, and we do not believe that the editor of the *Car Builder* would either, after calmly "putting himself in his place."

A Quick Steamer.

L. Holloman, of Tampa, Florida, seems to have his wits about him.

A valuable engine was in the roundhouse when it caught fire. When the engineer arrived the building was in flames, but he determined to save his engine He ran in the burning building, threw a pile of waste in the furnace of the engine, threw kerosene on it and lit it, and then was compelled to retreat to the water tank, as the heat was so intense that it was fairly scorching him. As soon as he thought the engine had steam enough to move it he threw the throttle wide open and ran ahead, and fairly came out through the flames with it In recognition of his service Mr Ybor presented Mr. Holloman with $50.—*Engineer*.

What a steamer she was! Even with the water in boiler at 212° all the waste and oil that could burn in those few minutes would not get up steam enough to move the engine. Guess she had some steam on hand, or got up her steam by the heat of the burning roundhouse—or the sun might have been shining on her through a window.

About Color-Blind Tests.

The color-blind tests now being made in England are going through the same forms tried here. It is the old story of an expert being placed in a position to force upon men a color test that is of no service to the railroad companies, or the employes, and only serves to show that the examining surgeon has studied up some optical delusion hokus-pokus.

Railroad men are required to distinguish between red, blue, green and white signals, and it is of no earthly use to oblige them to distinguish *shades* of wool, or anything else.

The only fair color-blind tests must be made with actual signals in the open air, and THE LOCOMOTIVE ENGINEER has always advocated this test, and condemned any "catch" tricks Our advice to all railroad men, where color tests are being made, is to invite practical tests, but to resist the removal of men who cannot tell the "shades" of different skeins of wool, or tell the names of letters shown in a room at some distance—they are a fraud.

We are pleased to note that the United Enginemen of England, with their consulting engineer, Clement E. Stretton, at their head, are demanding a practical examination in a practical way—without fringe.

Arrested the Wrong Man.

Near the gates of Rose Hill Cemetery at Chicago, where an average of thirty funerals a day pass, the Northwestern road crosses the street.

This crossing has no gates and no watchmen, and the trains come upon it from a short curve. On January 23 the Milwaukee express, engineer Mahoney, struck the mourners' carriage of a funeral here, and killed six people, and, of course, has been arrested.

Had engineer Mahoney failed to make his time because he was afraid of killing people at crossings, another engineer would have been put in his place.

There are several men who need arresting for this crime—for crime it is—before engineer Mahoney is placed under the ban of the law. The first should be the officers of a road that maintain unguarded crossings at such a busy street, then the city officials should be taken in hand who permit such a danger to exist; and after that arrest, all the male citizens of Chicago more than twenty-one years of age, who tolerate officials who wink at such man-traps. After these, it would be well to arrest engineer Mahoney—if the crime has not been proven on those tried before him.

The engineers of this country are getting tired of being arrested for manslaughter in which they but act the part of the knife in the hands of an assassin.

Coolbaugh, McMunn & Pomeroy, 45 Broadway, New York, is the name of a new firm that will work for a railroad trade. They will represent Carnegie, Phipps & Co. in all their railroad work, axles, couplers and boiler steel; the Boies steel wheel and the Frost dry carburetter system of train lighting. It is especially gratifying to see men from the ranks of the railroad army get up. Mr. Coolbaugh is an old-time train dispatcher, of the D., L. & W., but has been for some years on the road for the Boies wheel. Mr. McMunn was for years with the American Steam Brake Co., and lately with the Martin Steam Heater Co., and Mr. Pomeroy is a mechanical engineer who has been for some years, as he still is, secretary and treasurer of the Suburban Rapid Transit Railroad, of this city. If energy and "rustling" will establish a business, these three men ought to establish one.

The Locomotive Fireman's Magazine for 1890 is out with a new dress and a new cloak. The *Fireman's Magazine* never follows—it leads. It never does anything because some one else has, or because it has. When an improvement is suggested, and, on investigation, looks well, it is adopted. Every New Year's since we have known it, it has come out in a new cover, and we think the last the handsomest and best. It is plain and business-like. The *Magazine* has 100 pages—and there is something worth reading on them.

Mr. Lockwood, the owner of the Shaw locomotive, deserves to win in his arguments on the hammer blow. He has been hammering away on the subject for the past five years, and seems to just be warming up to the subject—hasn't got to thirsty yet.

Who has a good drawing or other picture of a Ross Winan camel-back locomotive?

A New Attraction.

One of our readers, Engineer J. H. McDonald, of Monett, Mo., writes us of an unsual sight he recently saw from his locomotive. He says:

To-day (January 22d) at 11.35 A. M., I was coming east on train 36, and was just pulling into Hallowell, Kan., seven miles east of Oswego, when my fireman halloed three times:

"Look there! look there! look there!"

I sprang to the gangway on his side of the engine, and saw a sight I shall never forget. One-quarter of a mile from the track was rolling a large two-flued boiler, and an immense cloud of steam was to the west of it, which, when cleared away, revealed a two-story mill with one side well shattered, and we knew the boiler had exploded. As we were on time, and nothing due soon, we all, except the fireman, jumped off and ran over to the mill, and saw the boiler and ruins as we approached.

The near neighbors carried away two men, whom we supposed to be dead, but learned since that they are alive and may get well. One of them had his leg broken, and both were considerably scalded. I examined the boiler, and found the end blown out and the two flues with it. Most of the end was, I think, less than one-eighth inch thick, and I took hold of one piece, which was four inches wide and about 18 inches long, and fast to the boiler at one end. I could bend it up and down like a bit of galvanized iron. There appeared a ridge around the boiler where it looked quite thin, which, I think, had been stove out by the boiler lighting on end. My fireman says it went about three hundred feet high, but most eye-witnesses think he is mistaken—that he saw pieces of the smoke-stack. At any rate, the boiler is one hundred yards from where it stood. One of the citizens of the place told me that one engineer had quit work there a few weeks ago because he thought the boiler dangerous, another said he had known that boiler over thirty years, and it was an old one when he first knew it, and they had been looking for it to blow up for a long time.

[We hope that the Western roads won't get to racing each other in showing up strange and startling scenery along the routes. Cyclones, water-spouts and earthquakes are hard to get, but boiler explosions are cheap, and therefore liable to be used more. We don't like the idea.]

More Like It.

An associated press dispatch from Chicago, says:

The jury in the United States Circuit Court yesterday awarded Henry Bush damages of $40,000 in his suit against the Northern Pacific Railroad Company. In October, 1888, Bush was fireman on a construction train in Idaho, which was run into and wrecked by a "wild" train.

Bush was so badly injured that he lost the use of his legs. He alleged negligence on the part of the division superintendent. The award is the second largest ever given in the United States.

When a young man, at the very threshold of his usefulness, goes out on a road, and is maimed for life by the carelessness of officials or other employes, it is no more than just that he be paid heavy damages—enough to enable him to live decently off the income from it.

This idea that from $100 to $1,000 is enough for killing and crippling men is wrong—put yourself in his place, and think what you would want.

The compound built by the Schenectady Locomotive Works is doing good work on express trains on the Michigan Central road. She has but two cylinders, and is arranged so that high-pressure steam is used in both cylinders until the first revolution is made, when the intercepting valve between the cylinders automatically changes her to a compound. She rides well, steams well, is economical on fuel, and, more surprising yet, is very good on a start. She is now undergoing her trial trips, is being indicated, etc., and we will know by next month what she is worth in train service. There has been some little annoyance from her low-pressure valve pounding the seat when shut off and in the corner, this has been helped by cutting out the inside lap.

Piston Rings.

By J. J. BINOLET.

Some time ago we got two steam hammers 8" and 10" cylinders, and in taking the pistons out to get the size of the rings to have duplicates made, in case of breakage, I was surprised to find the 10" rings were only ½" wide, and made of steel, which I conceived would make good scrapers, if the cylinder ever got dry. We replaced them with cast-iron ones of ½" wide by ¼" thick, and in looking over some steam pump pistons I find the rings very narrow. Now, after long experience with cylinder packing, I find this to be true, the smaller the surface the quicker the wear, and *vice versa*. When we first began to use the spring ring, or, as sometimes called, the steam ring, we thought ⅝" square the best size, thinking that the narrower the ring the less the friction, but we soon found it was necessary to have a good stock on hand to replace broken and worn-out ones, then we got to ⅞" square, and we soon noted the difference in the length of service, and as it has been said experience makes fools wise, we tried to profit by it, and finally got the rings to 1" wide by ¼" thick for 15" to 20" cylinders, leaving ½" on each end of piston head, and ¼" between the rings, making the heads as light as possible, and I found that having the rings the largest part of the wearing surface, the cylinders were kept nearer round. Some of these rings run over two years on passenger trains making 220 miles per day. About every four months we would take them out, and pene them on the inside until the ends would stand open about ⅛" with a cross pene hammer, slip them in again, and they were good for four months more. Some of these rings were ⅛" or less thick when thrown away. I see occasionally pistons advertised as self-balancing, or that distribute the weight of piston equally over all parts of the cylinder. I never found any of that kind except on some English engines that had the piston run through the front cylinder head, with a stuffing-box in each head. It is really amusing to hear men talk of extra springs, bolts, steam let into the piston head, etc., to keep the weight of piston from wearing on the bottom of cylinder. The next best thing to do is to make the rings the largest part of the wearing surface.

Watertown, N. Y.

A New Disease for Engineers.

Walking down Champa street, Denver, from the convention hall, one day last fall, the writer was overtaken by a party of delegates, and, after trading cards and grips, we all steered for Larimer street.

A little way ahead of us walked a tall man, wearing a broad-brimmed hat and a railroad swagger.

"That's an engineer from Texas, I'll bet four shillings," remarked one of our crowd.

"How do you figure that out?" asked another.

"See the way he carries his head, sort o' to one side, the right ear about an inch higher than the other?"

We all said "Yes."

"Well, that is what we used to call the 'crane neck'; some call it the 'water-crook.' That is caused by a man's having to look so long and anxious at the lower end of the gauge glass to see if there is any wet steam in the boiler after shutting off."

The speaker stopped to light his cigar, and then resumed.

"I used to run in Texas myself, and if I had stayed there six months longer, fooling with that bad water, I should have had a permanent set in my neck. I got away just in time."

Watson & Stillman, of this city, manufacturers of the Vreeland transfer jack, have recently improved that very useful shop tool by placing the pump at the end instead of the side of the carriage, and otherwise arranging smaller details so as to make them accessible and handy.

Our correspondent, De Sanno, has invented and is now perfecting a locomotive valve motion.

Been There Myself.

By W. D. HOLLAND.

In looking over Mr. D. W. Cowan's article, headed "A Licensed Engineer's Idea," in your January number, I was rather surprised to hear of the immense knowledge those gentlemen are under the impression they have in the South. D. W. Cowan says Mr. Cushing's questions are only for young engineers and firemen, but still he says he has been running an engine two years, and he knew better than that himself, in speaking of one of Mr. Cushing's questions, in which he gets things very badly tangled up in trying to solve. He also quotes, "We are all licensed engineers down here, and that is where we are ahead of the engineers in the Northern and Western States." (Wouldn't that kill you?) It is a well-known fact that any one can buy a license in Alabama at a trifling cost, in fact, a smart school girl can answer the questions by reading over a few mechanical books on "How to Obtain a License for Engineers." He concludes by saying: "A man has to be a first-class man to run an engine down here. We have a book to study on railroading, and have to run a train and protect it." That Book of Rules must have been revised lately, from the way they railroaded there a while back—that was when both trains started out of each end of a division of probably 100 miles, and would keep moving till they met each other, or where the darkness of night would overtake them, when they would silently repose till the following morn, when they would proceed on their long journey; but should they meet each other on the main line in daylight, then the one that was hauling logs, which would be the inferior article, would, of course, back to the next siding and let its superior pass. Can it be really possible that all this has come to pass in these last few years, and, as Mr. Cowen says, we all first-class men? Would it not surprise the snow-digger of the North, or the wild and woolly men of the West, to saunter back again and strike some freight man for a ride, and not to hear that old familiar phrase in return, "Stranger, I can't tote you, as I have been on this year line for 20 years and never toted a man yet"?

Oakland, Cal.

Work on This Line

In a distance of from 1,200 to 1,500 miles, the Central Pacific road does not touch a coal field, and the coal burned on the road comes from the far East, and from Australia and New Zealand. This coal costs the Central Pacific Company from $7 to $8 a ton, and the road annually consumes 900,000 tons of the fuel, or about $7,000,000 worth.

As fuel is now burned in the furnaces of locomotives there is a waste of from 50 to 75 per cent., that is, if the heat could all be utilized, a ton of coal would do almost twice as much for us as it now does. Figuring the waste in connection with the annual cost of coal for the Central Pacific Railroad at 50 per cent., it would be $3,500,000, and at 75 per cent., $5,250,000. The amount of coal used by the railroads of the United States is a stupendous aggregate, and the amount lost through the waste of the energy of the coal is an appalling sum.

Inventive genius can find no grander field than this search for a way to utilize every pound of energy that exists in a ton of coal.—*Ex.*

About the first thing the proprietors of a new invention do is to get out circulars and reports of tests, and claim from 20 to 80 per cent. saving over ordinary devices. If railroads would buy all the devices that are offered to them under these promises, they could put enough patents on their engines—if the promised saving could be done—to run 500 locomotives a year on one ton of coal. This percentage business has been overworked.

The machine snow-plows have had elegant opportunities to show off their merits in the great snow banks in the Rocky Mountains. There is lots of snow there yet, ready and waiting to be "lit."

The Strong locomotive A. G. Darwin was in a bad rear-end collision on the C. H. & D. early in January and was somewhat stove up.

The English compound on the P. R. R. has been repaired, and is at work again.

THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

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Heavy Mason-Farlie Locomotive for the Central Mexicano.

Our large illustration this month shows one of five heavy Mason-Farlie locomotives recently turned out by the Baldwin Locomotive Works for the Mexican Central road. These engines have the frame of the tender fastened solidly to the fire-box and boiler, the slab frame extending ahead just under the running board to the heavy center casting under the boiler, as shown. To those not familiar with the Farlie engine it may be necessary to state that the engine is separate from the boiler, and can move under it, just as a truck of a car can move under the car body. There is a heavy saddle casting bolted to the center of the barrel of boiler, that rests on an immense casting across the frame of the engine.

The steam pipe comes down through the bottom of the front end, and has a ball joint between it and a pipe that extends back almost to the center casting; here is another ball joint—held together with coil springs—that joins a return pipe to the cylinder saddle, where it joins by another ball joint.

The exhaust nozzle extends up into the arch through a slotted casting, the slot being covered by a slide that fits up against it, held by springs; this slide is tight around the nozzle, and will admit of considerable movement without opening the front end to the atmosphere.

In rounding a curve, the steam pipe opens out, like a pair of lazy tongs, and keeps up the supply of steam, and the engine is enabled to dodge around under the boiler as much as the truck does under the tank.

In these engines the regular shifting link motion is used, the tumbling shaft shown being fast to the boiler, and connected to the tumbling shaft proper by ball joints. These engines are equipped with the clumsiest and meanest reversing gear we have ever seen—the rack and pinion style. There is a quadrant, cut full of small teeth, the reversing lever comes up just *under* this quadrant, and forks around it; journaled in the forks, and meshing into the teeth in the quadrant, is a small pinion, and on an extension of its shaft a hand-wheel—like a brake wheel—about 12" across, is provided to turn the pinion. On a projection of the forked end of lever, and ahead of this hand-wheel, is a smaller spoked wheel, on a set-screw, which is used to hold the lever where wanted. The device is very unhandy, requiring both hands to set it, and is slow. The common reverse lever is at once the simplest, quickest, cheapest and safest device for reversing a locomotive engine, occupying less room, and requiring less care than other devices.

These engines are exceptionally neat, well designed, and well finished, they are very large, and set up high; the boiler head in the cab is lagged, and every improvement at hand. On top of the cab, and raised above the roof some six inches, there is a corrugated iron roof, or canopy; we suppose this is to make the cabs more endurable in the heat of a Mexican summer.

This class of engines are noted for their easy riding qualities, and the cabs are particularly comfortable in winter, there is no pounding between engine and tender, no draw gear to break, no water or air hose, and no gangway, but there are objections to them in their great length, the flexible steam pipe, etc. Like all other railroad devices, they have their advantages and disadvantages.

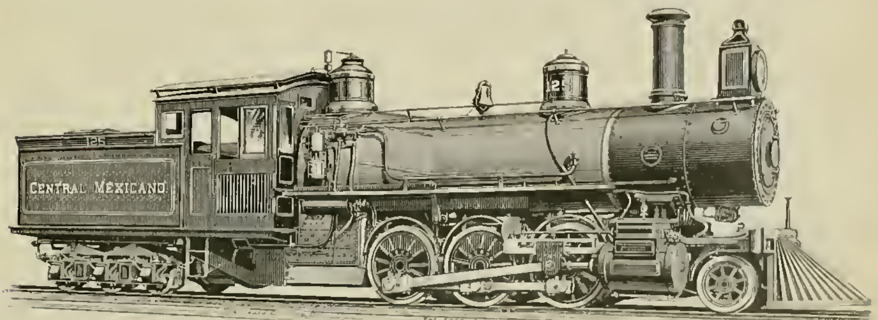
The principal dimensions and weights are as follows:

Total weight with tank ¾ full of water, no coal	173,900
Weight on driving wheels	93,200
" on front truck	17,700
" on front truck and driving wheels	110,900
Weight on rear truck	63,000

Cylinders 20" diameter by 24" stroke.
Boiler 56" diameter, wagon top.
Dome 28" diameter.
Fire-box 81" long, 53" wide and 77½" deep.
230 iron tubes 2" diameter, and 13' 8" long.
Heating surface:

Fire-box	151½ sq. ft.
Tubes	1,645¾ " "
Total	1,797 " "
Grate surface	29¾ " "

Wheel base, driving 9' 1", total 40' 11¼".
Driving-wheels, three pairs connected, 48" diameter, with 43" centers.
Driving-wheel journals 7½" x 10".
Truck wheels 30½" diameter, steel tired.
Truck wheel journals, front 5" x 10", back 4½" x 9".
Tank capacity 3,500 gallons.



Wm. Stroudley, Supt. of M. P. of the London, Brighton & South Coast Railroad, of England, recently died. Mr. Stroudley was the designer of many forms of locomotives and cars, and his fast passenger locomotive, the "Edward Blount," received the gold medal at Paris last year. This engine has a trailing wheel or truck back of the drivers, but none ahead. Mr. Stroudley had the reputation of having the neatest and cleanest locomotives in Europe; he came up from the ranks, was a practical man in every sense, and a remarkable organizer. When he took charge of the L., B. & S. C. shops and motive power in 1870, they were considered the most disorderly and badly managed ones in the country; he brought these from the bottom to the top.

The net earnings of the Pennsylvania lines, east and west, for 1889, were $21,510,457, an increase of almost $3,000,000 over 1888. This is the more remarkable because of the dull year in anthracite coal trade, and the cost of the great flood in June. This flood cut out a proportion equal to $1,149,882 from the earnings, beside the cost of repairs to permanent way, and the replacing of wrecked rolling stock, in itself something enormous.

Originality.

The following news item is floating around, and it is said that a number of railroad officials, fearing that the plan might become as contagious as the other Russian grip, have recommended vigorous quarantine measures, and the vaccination of American juries against it.

"An engine driver on the Central Asian Railway, who sustained concussion of the brain in a serious accident on General Annenkoff's line some time ago, has just sued the railway officials for damages in a court at Samarcand, and obtained very satisfactory and somewhat original compensation. The court decreed that he should be paid 7,000 rubles down at once, and in addition should receive 30 rubles, or $15 a month, with an extra 10 rubles for every child which might be born to him."

Justifiable Homicide

When the next issue of this paper comes out there may be a new steersman at the wheel—the present editor may be the occupant of a vermin-infested cell at the tombs. There is a demon in our heart, and he is quietly whetting his scythe with a leer of revenge upon his face.

After the last paper was out, and we had looked it over, we went from the hallowed presence of our blonde type-writer, held up our right hand, and swore by the whiskers of the Great Horn Spoons that the next time any printer made us call E. J. Rauch E. J. *Ranch*, or made us say that the Webb compound had only *one* exhaust to a revolution, or made us call a valve stem a valve *steam*, or a port a *part*, or lap *lop*, that we would murder him.

We swore that we would lay in wait for him among the murky passages of the back stairs, and stab him with a petrified editorial, haggle him with a meat saw, and tramp on his remains, and flay the air with him until the coroner could find nothing but dried blood, besprinkled with a few whiskers, and, perhaps, a few buttons, but nothing else

Steam Snow Plows

The great blockade of snow in the Rocky and Sierra Nevada mountains gave the different designs of rotary snow plows a chance to be tried. The Leslie, Jull and Cyclone all bored their way a considerable distance into popular favor.

These large wheels are comparatively light for the size of the cylinders that drive them, and the break-downs appear to be caused by the empty fan revolving at a high rate of speed striking a heavy drift, thus throwing a very heavy load upon the machine. So far, we believe, the speed of the plows has been governed entirely by hand. Why would not a good steam engine governor prevent racing of the engines, and supply steam in accordance with the work ?

Heavy Damages for Jumping.

A dispatch from Mansfield, O., says

"The jury in the case of Boyd W. Miller against the New York, Lake Erie & Western Railway Company, for $30,000 damages, brought in a verdict to-day. It gives Miller $21,850 damages for injuries he sustained at Akron about two years ago, when he was running a road engine, which collided with a switching engine in the Akron yards Miller was an engineer, and, to avoid injury, he jumped from his engine when he saw that a collision was inevitable. His injuries from jumping were such as to totally disable him for work. The case has been tried twice The first verdict was for $30,000 "

We have always advised men to jump when it was the only means that seemed at hand to save their lives. It seems that this court does not blame the man for jumping, and award him damages the same as if he had stayed on the engine and been injured there.

The engineer, fireman and conductor of the Rock Island freight train that ran into a passenger train in Chicago, killing seven persons, have been acquitted. Leaving the engineer and conductor to take care of themselves, we fail to see why any jury would not award fireman La Cloche damages for false imprisonment—he had no responsibility and no chance to prevent the accident.

A Handy Crane for Handling Steam Chests, Covers, Valve Seat Planers, etc.

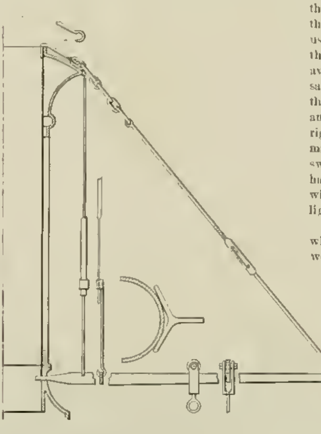
The device shown on this page was designed by Master Mechanic H. D. Gordon, now in charge of the new shops of the Pennsylvania road at Altoona, while he was at the head of the mechanical department of the Philadelphia, Wilmington & Baltimore road, at Wilmington, Del.

Cranes for handling air pumps, chests, lids, etc., that fastened to the hand rail, were found impractical on account of the light hand rail in use on the P. R R

This crane is strong, rigid, can be attached without screws or bolts, to stacks of any height, will swing considerably, and handle work six feet from the stack

The arm that carries the trolley has a fork at its inner end, that rests against the base of the stack, this arm is an inch thick, 2¼" deep at the large end, and 1½" at the outer end.

The support, or truss to top of stack, hooks onto outer end of arm, and carries on its upper end a few links, terminating in a hook ; when the hook is dropped into the stack, the links admit of the truss conforming to the different forms of stack tops, in the center of this truss there is a turnbuckle, to admit of lengthening or shortening the truss to keep the arm level.



From the stack hook, a lighter chain and rod reach to the trolley arm at base of stack, to hold it up, this is adjusted as to length by a pin and socket, as shown.

This device is very light and portable ; one man can put it up and lift any chest, chest cover, or valve-seat planer alone.

It is of no use to give dimensions, as the size of engines in service would have to govern that It is a very handy roundhouse tool.

Some Kinks in a P., W & B Shop.

The P., W & B. road is under the control of the Pennsylvania, but its shops and engines have an individuality of their own.

The main shops of the company are at Wilmington, Del , are under the management of Master Mechanic Turner.

These shops are quite extensive, but cramped for room, and awfully crowded, machines elbow each other good-naturedly, especially in the tool-room, where each machine knows all about the family secrets of his neighbor.

Most of the tools are new and of approved design, and the work turned out is first-class All the tools for the shop are ground in the tool-room by a Sellers universal tool grinder In the tool-room are a large stock of counterboring tools, every bolt-hole in their work being counterbored at each end, so that the head and the nut come down fair

The usual design of a counterboring tool has a center plug turned up true, that fits the hole to be counterbored. This is expensive to make and temper, and this guide is constantly being distorted by grinding the cutters Here the guide is separate from the cutter, and has a shank with the Morse taper that centers it in the tool. It is easy to see that different sized guides can be used for one size of tool; that, as it is removed in tempering and re-grinding, it is not changed, and fewer tools will do the work

Rod brasses are here made entirely on milling machines, and at very little expense.

The method of holding cellar in driving and truck boxes is subject for illustration in another column.

In the shop there is a novel crane over each engine pit. A separate frame is built inside the shop, of timbers about eight inches square, posts stand at the back end of and between the pits to support the frame, the front end posts being against the front of building and between the doors. At the back end two timbers lying side by side form a track between the posts, and on them run two wide-faced wheels of small diameter, say eight inches, these wheels carry the back end of a wooden track that is pivoted in the center of the cross timber at the front—only moving behind On this swinging timber runs a trolley that carries beneath it a chain hoist operated by hand. The back end of this track can be swung from one side of the pit to the other by ropes coming down at the posts. By using this simple rig in stripping and assembling the parts of a locomotive, much hard lifting is avoided It will pick up a cab, dome cover, bell, sand-box, air pump, chest cover, etc., and put them on the floor or a truck beside the engine, and, of course, can be used to replace them. The rig is cheap, and can be used to good advantage in many ways. Take, for instance, a saddle tank on switchers, they are a clumsy and unwieldy thing to handle where no crane can be brought to bear, but with so simple a rig as this, a couple of men make light work of it.

In the shop yard they load and unload car wheels, as well as place them on the scales for weighing, by a simple air cylinder, such as shown in our March, 1888, number. This works very quickly and safely.

The boiler shop is supplied with good tools and modern appliances for power riveting, etc., and the blacksmith shop has a good many dies for standard work. They run a number of power hammers of the belve pattern, and a number of steam hammers They have a special rig of their own for holding long truss rods while the end is being upset for the thread.

The crowded condition of the shops has called for several innovations to save room. Locomotive boilers are set up over heating furnaces, and the fire-box and flues made to do duty as part of the chimney These boilers were popping off at 60 or 70 pounds of steam.

There are several engines about the shops, and one very large upright boiler is used at the boiler shop, to save room. The boiler-room is also made to do duty as a tool-room for the erecting shop.

They use a large tumbling barrel to clean flues It has wooden staves put on spirally; a two-inch stream of water is kept running into the barrel, and the whole thing is boxed up in a heavy plank shed that very effectively drowns the noise. We were told that a surprising difference was noted in amount of work the barrel would do using water, over the old dry plan.

A 85-foot drop table is used, this table is raised and lowered on eight screw-jacks, operated by worms on two shafts driven by power.

One of their kinks, in the shape of a crane for chest covers and seat planers, is illustrated elsewhere in this issue.

Wm. Wright is general foreman here, and the drafting-room is in charge of F S Evans. This room is badly located, being used as a sort of hall to the pattern store-room, and is in the second story, right beside the main track, where all the passenger trains stop—the pops and bells keep the ears busy, while the smoke interests the eyes and the drawing paper. Yet, with all these disadvantages good work is turned out, and a systematic scheme followed in filing away drawings and blue prints.

Perine's Rod Cup.

The accompanying engraving shows the arrangement of a new rod and eccentric cup, recently patented by D. M. Perine, an engineer, of Baltimore.

As will be seen, the feed is of the plunger type, but has a shoulder that fits upon a seat, thus preventing the oil from running out when the engine is at rest, the feed only occurring when the cup is in motion. Feed is regulated by a screw, as shown.

A conical spring is used to keep the cover tight, the under side of the top of the cup is concave, and the pressure of the spring keeps the disk with the leather top in the center and tight.

With these cups, simplicity and quickness in filling is a great feature; with the old style it is necessary for the engineer to unscrew the tops with a wrench in order to fill them; with this he has only to press the end of his oil can against the closed hole in the top, withdrawing it when the cup is full, the opening closing automatically, oil and dust tight, doing away with all danger of cups being loosened or broken off by constant screwing on or off of tops or loss of tops from failure to screw them up tight.

In this way a great amount of time is saved, and a great quantity of oil, as engineers will often pour the oil direct upon the bearings and journals, on account of not having time to unscrew the tops, three-fourths running upon the ground, and is a total waste.

About Brakes Leaking Off.

If the piston in the cylinder of the air-brake does not travel more than three inches to apply brakes, the brake will leak off through the leakage groove in the bottom of the cylinder. This often happens in freight service, where the brake beams are hung from the body of the car; when the dead levers are taken up, when the car is heavily loaded, the shoes are brought nearer the center of the wheel when the car is light, and the piston travel is short.

When this trouble strikes you, don't lay it to the new engineer's brake, and equalizing discharge valve, there is a cause for all these things—find that cause.

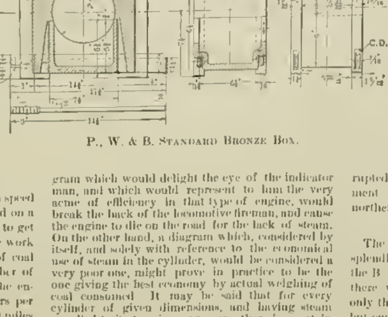
Standard Bronze Driving-Box, P., W. & B Railroad.

On this page will be found drawings of the standard driving-box for 17x24-inch cylindered locomotives of the P., W. & B. road. These boxes are made of solid Crown bronze, and are provided with the cellar-holding device., recently patented by J. M. Wallis, Supt. of M. P.

As will be seen, the cellar is held up by two wedges located in slots cored in the sides of box; the wedges do not pass through holes in the ears of the cellar, but under shoulders at the bottom; the cellar makes a fit against the box each side of the axle, and the cellar being held rigid, cannot wear loose, and is always ready to come out when the wedges are loosened.

These wedges are held in by half nuts on the smaller end. On engine trucks, where there is not room, or where these nuts would be hard to reach, the wedges are held in by a set-screw through the box.

On a recent visit to the Wilmington shops we saw solid bronze boxes weighing 850 pounds, being finished for some heavy engines in process of construction.



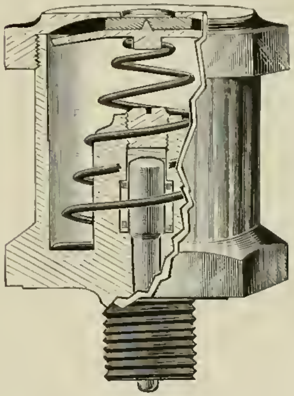
P., W. & B. STANDARD BRONZE BOX.

The Railroad Gazette says: The maximum speed on the elevated roads is 25 miles per hour, and on a level line it requires from 1,000 to 1,200 feet to get up speed. The average horse power to do the work required is 145. The average consumption of coal per mile is 45 7 pounds. The average number of miles run per ton of coal is 49 4 pounds. The engines work on an average of about 20 hours per day with two crews, each crew averaging 70 miles and making 208 stops during that time.

The Indicator on Locomotives.

A writer in the *American Machinist*, who evidently knows what he is writing about, has the following to say on the above subject

There is one point in connection with the use of the indicator on locomotives, which we are persuaded is quite too frequently overlooked. It is too often forgotten that the boiler and the furnace are inseparable parts of a locomotive engine, and that, owing to this fact, it frequently happens, and indeed is usually the case, that what would be nearly the ideal indicator diagram for a stationary engine would indicate poor results for a locomotive having the same size cylinders and doing the same amount



PERINE'S ROD CUP.

of work at the same initial pressure and speed.

The performance of a stationary engine in no way affects the economical performance of the boiler which supplies it with steam, and an indicator diagram from such an engine merely shows the performance of the engine only, indicating among other things the pressure at which steam is admitted to the cylinder, regardless of whether that pressure is economically or wastefully maintained in the boiler, the manner of using the steam in the cylinder having no effect whatever upon the economical combustion of fuel in the furnace

With the locomotive the conditions are essentially different, because the exhaust is depended upon for the blast by which the fuel is burned and the steam kept up. It thus frequently happens that a diagram which would delight the eye of the indicator man, and which would represent to him the very acme of efficiency in that type of engine, would break the back of the locomotive fireman, and cause the engine to die on the road for the lack of steam. On the other hand, a diagram which, considered by itself, and solely with reference to the economical use of steam in the cylinder, would be considered a very poor one, might prove in practice to be the one giving the best economy by actual weighing of coal consumed It may be said that for every cylinder of given dimensions, and having steam supplied to it at a given pressure, there is a certain distribution of steam which is the best one for that cylinder when doing the given amount of work. This distribution will be shown by an indicator diagram, which will represent the ideal conditions for that engine and for that work But if the engine is a locomotive engine, the effect of the exhaust upon the fire must be taken into account, and there are many things about the boiler and fire box, and in the front end, which may have an effect on the character of the exhaust required to give the best results. The kind of coal used, the form of the grate-bars, the size and number of flues, the diameter of exhaust nozzles, or the variation of an inch in the height of the petticoat pipe, may materially alter the character of the blast needed to produce the most efficient combustion of fuel, and, as this blast is furnished by the exhaust steam, the steam distribution and the indicator diagram representing the best possible performance will be correspondingly modified. This, of course, is no argument against the use of the indicator on locomotives, but should serve as a reminder that the indicator, like everything else, should be used only for the purpose for which it is adapted, and it certainly was never intended for the indication of boilers or fire-boxes. The use of the indicator has in the past been confined mainly to engines in which the exhaust has no direct effect on fuel consumption, and the theory of the indicator has been developed by such use of it Those who propose to use it in locomotive practice must make the proper allowances for the different conditions, and failing to do so they should not blame the indicator, and declare it to be a humbug because they fail to get satisfactory results from it

This is a matter too frequently ignored, it should always be remembered that the best indicator diagram from a locomotive is in the nature of a compromise between the cylinders and the boiler.

Murder, Just the Same.

The press dispatches of February 24th contained the following from Erie, Pa.,

"This afternoon as the west bound Nickel Plate passenger train reached the 150-foot high bridge over Walnut Creek, near Swantown, the engineer saw a man in the middle of the bridge The train was running at the rate of forty miles an hour, and to reverse it on the bridge would have imperiled the train and its 100 passengers Although the poor fellow stood wringing his hands in agony, and looked pleadingly at the engineer, the brave man at the lever kept on and sent one man down 150 feet into eternity rather than imperil the lives in his keeping. The man was unknown and was penniless."

We can hardly believe this, but it may be true. If this engineer could have stopped by any means, and did not, murder, pure and simple, was committed It is a poor bridge that won't stand the strain of stopping upon it; and if this was such an one the officials of the road should be prosecuted. If there was no danger of the bridge, and the engineer could have stopped, it is his hand that is red with his brother's blood. We are inclined to believe that he saw the man when it was impossible to stop, and that the theory here given was agreed upon by the witnesses, and used by the reporter. Such items are mischievous and tend to educate the masses into the belief that train and enginemen are careless of human life, and the railroads running on weak and rotten bridges, then, when the public, who have got these ideas, get on a jury, they proceed to do injustice to get even. When a man is "unknown and penniless" here seems to be an excuse for experimenting on him.

The railway from Lulea, in the Gulf of Bothnia, to Elyegaard, in the fjord of Ufoten, Norway, which is now in course of construction, is the most northerly in the world It traverses the mountains between Sweden and Norway, and the work is sometimes interrupted by the severity of the weather. The government railroads of New Foundland are the most northerly in the Western hemisphere.

The Hall automatic block signals have made a splendid record on the N Y , N. H. & H., and on the B & A For one year on the first-named road there were 365,005 operations of the signal, and only thirty-seven unnecessary stops made—this is but one in 9,865, on the B & A there were 20,761 operations, and not a single unnecessary stop

Some Boiler Shop Kinks.

John Mitchell, foreman of the D. & R. G. boiler shop at Denver, has in use a great many tools and appliances of his own invention, not the least useful of which is the device shown in the accompanying sketches.

The frames of these boiler blocks are made of plate, strongly stiffened with angle irons all around them. Fig. 1 shows the forward one, and the manner of securing a boiler to it. Fig. 2 is the back or center support, and has no holding-down tackle.

By mounting a boiler on the rollers as shown, and holding the front end down by the top rollers, the boiler can be turned in any desired shape and secured there, the entire fire-box end being free.

This shop has to deal with a great many heavy boilers with shallow fire-boxes, and this rig is found particularly efficient in this work.

When riveting crown stays, the boiler is turned bottom up, as shown, and the men get on top of the crown sheet, where they can work down; when it comes to side sheets the boiler can be laid on its side if desirable.

Fig. 3 shows another horse or block, somewhat lower in the center than the other—the radius of the circle being greater than that of any boiler in use. Around this circle are heavy angle irons, with holes in them to receive loose pins, as shown at *a*. This block can be placed under the boilers at any point, when they are on the blocking, and its use is to hold, or help hold, the sledge while the boiler makers are heading down a rivet or stay.

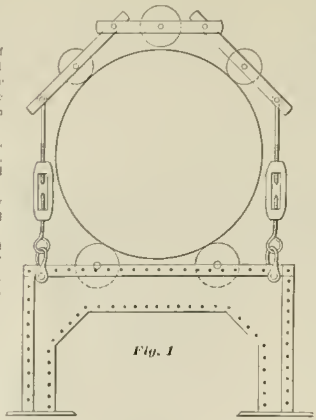


Fig. 1

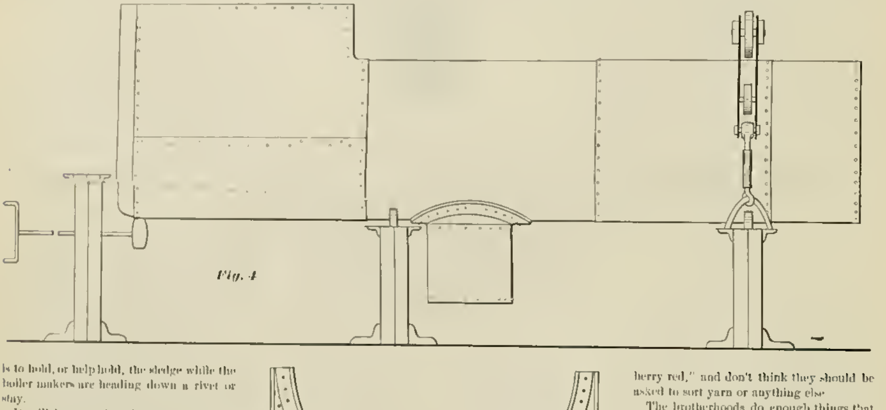


Fig. 4

It will be seen that, by using the sledge as shown, it is very easy to follow seams, either longitudinal or circumferential, the long iron handle gives a great leverage, the sledge holder is away from the noise, and it has been found that the sledge boy will hold up harder, if he can do it, by laying down on the double handle, than if he has to hold a 25 pound sledge up over his collar bone.

By this system of blocking, any tools, such as drills, can be got to any part of the fire-box, outside or inside. There are no castings used, and the rig can be made of boiler shop scrap—and it is a good one.

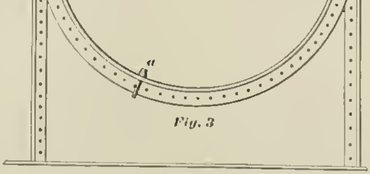


Fig. 3

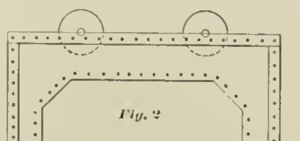


Fig. 2

The Baldwin Works are turning out a number of locomotives for the Argentine Republic; they are 8 wheelers, very much like American engines, but have some of the ideas imported into that country from England. Copper fire-boxes, stays and flues; pumps on a cross-piece between the frames, driven by an eccentric; iron cabs, and wrought-iron wheel centers. Baldwins now make their own wrought iron wheels by a process recently patented by Supt. Vauclain; the wheels are built up of properly shaped pieces, and the whole mass welded in dies under a powerful hammer. There is liable to be considerable use for small wheels of this kind, but wrought-iron driving wheel centers are not so good as cast-iron ones, and cost much more; wrought-iron is more of a yielding substance than cast, and tires on such wheels soon become loose. These South American locomotives are painted a light color, yellowish gray or bronze.

A Color-blinded Item.

A number of locomotive engineers of the Central of New Jersey, who were removed and given positions as firemen and yardmen, several months ago, on account of color blindness, have recently asked, through their Grievance Committee, to be restored. We are glad to observe that Superintendent Olhausen refused their demand, and that the men were sensible enough to acquiesce. Requests for such unreasonable and even dangerous action as this are among the most foolish acts of the engineers' brotherhood, and go far to injure their cause when they present reasonable demands.—*Railroad Gazette.*

The above item seems to have been penned with the idea of putting the brotherhood in a false light; a number of the engineers on this road have assured us that there has nothing of the kind occurred. Color-blind tests have been made, and one or two men on the western division were temporarily taken off, and at their own request were given shifting engines, the brotherhood has not demanded the reinstatement of any men taken off for this cause. The men are most of all interested in having to run on a road where there are men who are color blind, and would be foolish to fight to keep a dangerous man in the service.

These engineers, like those on every other road we know of, are anxious that every man should go before a committee and be able to tell the color of a distant signal, through the open air—both by day and night. They don't know "crushed strawberry red" from "mashed raspberry red," and don't think they should be asked to sort yarn or anything else.

The brotherhoods do enough things that can and ought to be criticised, without such papers as the *Gazette* accusing them of something, just to be able to condemn it.

The Pennsylvania Railroad are going to build a unique monument at Bordentown, N. J. It will be erected on the spot where the first rails were laid in the State, and where the "John Bull" started out for the first time. Isaac Dripps handled her throttle on that occasion, and he recently visited Bordentown, to point out the exact spot of the birth of the Camden & Amboy Railroad. Part of the monument will be made of the original rails, and spikes used at that time. The "John Bull" is preserved in the National Museum at Washington.

In the shops of the Consolidated Safety Valve Co., at Bridgeport, Conn., there is a system of copper wires arranged overhead, so as to touch all belts. These wires are all grounded to a water pipe. Supt. Richardson made some experiments some years ago to determine what deposited large quantities of dust on ceilings, hangers, and around belts, and came to the conclusion that it was caused by electricity generated by the friction of the belt. Whatever the cause, the grounding of the wires in contact with the belts seems to have cured the disease.

An Improved Rubbing Iron Between Engine and Tank

On this page will be found a cut of a chafing iron, designed by Wm. Wright, general foreman of the P., W. & B. shops at Wilmington, Del. Most chafing irons that are set up by a wedge have the wearing surface directly on the wedge, and, after the engine has run some time, a hollow is worn in the wedge, and it is impossible to get it past this place until there is a great deal of slack between the engine and tank, and even then the tendency is to force the wedge back to the old place, often shearing or bending the pins, and making it hard to remove them. With this device there is no wear on the wedge, as it carries the chafing iron with it toward the tank, but not across it. The wedge has projecting ribs, as shown at *f f*, in Fig. 1, that hold it firmly against the buffer irons fast to the tail piece of the engine frame. The wedge enters the chafing iron proper, and is held to it by the flanges shown, *d d*. The chafing iron is held from moving in the direction of its length by the pin *G*, that is shown in both cuts; this pin is held in a slot in the buffer iron that admits of an outward movement only. The wedge is held in the buffer iron by a pin entering it through any of a number of holes, as shown at *H*, Fig. 2, or any other device now in use.

The face of the chafing iron is chilled, and is curved to admit of the engine and tender rounding any curve in the road, without cramping. This device is in use on switch engines on this road, doing the work in the Philadelphia yard, where curves of 75 feet radius are common.

Improved Variable Exhaust.

Master Mechanic John Campbell, of the Lehigh Valley road, at Delano, Pa., has recently put into use a variable nozzle with some novel features.

In the center of the stand, and on top of the partition, a chamber is cast, that is bored out to fit the plug, which is raised and lowered by the lever, as shown; this lever is inserted in a slot cored in the partition, and in no way comes in contact with the exhaust steam. By this arrangement there is no pressure on the plug that tends to lift it, and the actuating levers do not become fouled and unable to work.

Mr. Campbell uses a 5⅝-inch nozzle in his 8-wheeled passenger engines, with cylinders 20x24, and on consolidation engines with large fire-box, a 6-inch nozzle is used.

An Acrobatic Locomotive

Under the head of "A New Model Locomotive," the *Evening Telegram*, of this city, describes the Swinerton locomotive, with a single pair of driving-wheels, and a traction increaser, as follows:

"Residents along the line of the Central New Jersey Railroad have been greatly interested of late in the trial trips of a new model locomotive. The engine has a self-balancing apparatus which throws the entire weight on the single driving wheel at starting, and on the pony trucks, when under headway. It has also a compressed air device which rings the bell and ejects sand on the track at the proper time."

H. Tandy has resigned the office of Supt. of M. P. of the N. Y., Ontario & W., to take charge of the Brooks Locomotive Works as Supt. Mr. Tandy was at one time connected with the works as draftsman, and has received training that has fitted him for the place. As a rule, a railroad M. M. does not get the proper training for a manufacturer, although quite a number have succeeded at it. There is a great deal of difference between building different designs of locomotives for other people, bidding for the work in the open market, and making a profit out of it, than in building engines of your own design in a shop where lots of time can be charged to repairs. There are very few railroad shops building new locomotives, in connection with repair work, where it can be told, even approximately, just what the new ones cost.

Horatio Allen was the first man to run a locomotive in America. Who was the first to fire one?

On a large bridge at Belwa, India, bees have built no less than sixty-five hives or "combs," averaging nearly two feet long, upon the girders. The engineering department has been ordered to remove the unwholesome pests at all costs. The bees are said to make it lively for trainmen in daylight, but excuse the night men.

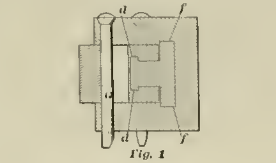
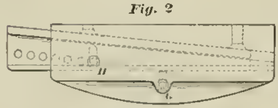


Fig. 1

Fig. 2



IMPROVED RUBBING IRON.

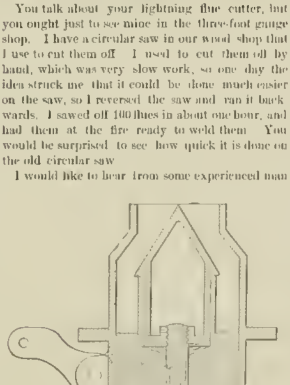
Correspondence

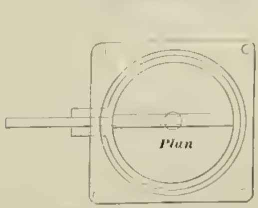
Some Kinks on Exchange.

Editor The Locomotive Engineer:

You talk about your lightning flue cutter, but you ought just to see mine in the three-foot gauge shop. I have a circular saw in our wood shop that I use to cut them off. I used to cut them off by hand, which was very slow work, so one day the idea struck me that it could be done much easier on the saw, so I reversed the saw and ran it backwards. I sawed off 100 flues in about one hour, and had them at the fire ready to weld them. You would be surprised to see how quick it is done on the old circular saw.

I would like to hear from some experienced man





NEW VARIABLE EXHAUST.

the quickest and best plan of cleaning old flues. I do not approve of the old way of rolling them, as you waste too much of the iron, or whatever material they are made of, also scraping them between two files wastes them away, and using a pick puts them too much, and putting in a strong pickle will injure the flue, so let us hear a good plan that is not injurious to the flue.

Now, Mr. Editor, this is my plan of swapping ideas; this idea of cutting flues is, so far as I know, original with me.

Do you know of any good boiler compound for taking scale from a locomotive boiler while in service, that will not injure the boiler, so that we could use that a month or so before bringing engine in shop, and the flues would be clean.

E. A. CAMPBELL, Supt. M. P. & Mach'y.
Houston, Tex.

A Texas Love-Letter.

Editor The Locomotive Engineer:

Please act as post-office department for forwarding the following note to my own true love,

MY DEAR MR. PHELAN:

Since your love letter has appeared in THE LOCOMOTIVE ENGINEER I feel that I owe you an apology for disturbing your intelligent brain, but you forgot to include in the numbers of the cars that this road has, one coach, one baggage car and one pay car; and whenever we appoint a foreman we get one who is a first-class runner and machinist.

Suppose we had 30,000 miles of road, and should keep up this plan with 100 engines on each division, where would your traveling engineer come in? Two men on one engine are company, and three are a crowd—especially on a narrow gauge engine, when you have to take a magnifying glass to find it, as you did. It looks strange that an article penned by a brainless man, or a school-boy, should upset as intelligent a man as yourself.

To your vast storehouse of assumed knowledge please add the following: "That abuse is not argument", "that argument is indeed weak which is mainly sustained by a tone and language common to the fish women of Billingsgate."

Come again and give us another letter. I feel satisfied that two as intelligent writers as you and I can swell up the subscription of THE LOCOMOTIVE ENGINEER to what it should be.

Let us hear from you soon. Good-by, darling.
E. A. CAMPBELL, Supt. M. P. & M.
Houston, Tex.

P. S. Mr. Editor, do you not feel proud to have such intelligent writers as us two for your paper?

[Yes, we are proud of you. People who know so little about railroads and railroad men that you can't notice it on them, said there would be a row when Campbell saw Phelan's letter. The editor had no fear of that; we have lived among railroad men too long, know them too well, and have listened to just such talk around roundhouse stoves too often. We let in these little sassy letters occasionally to make the men feel at home. Now, boys, you have had your say, take your seats and be ready to recite your lesson next month. No more bent pins go!]

Reverse Gear on English Engines.

Editor The Locomotive Engineer:

I desire to set you and the numerous readers of your valuable paper right, in regard to what you claim to be the difference between English and American engines, especially as to reverse gear. You say English practice is to have reverse lever on left-hand side. With few exceptions this is not true, as you would find if you went there. During several years' experience in running and considerable traveling in England, I found the general practice to be, to have the reverse lever on the right hand. The only exceptions that I remember seeing, were a few old-time engines on the L. & N. W. R., and a few others, most of which are, ere this, broken up. They also had a coal bunker on the right-hand side, where the engineer should stand, which blocked up the gangway, and the only possible way to get down off the footboard, was on the left hand side. These seemed to have been built more as an experiment than for general practice. We see by the sketch of the North Star, in this year's January number, that the reverse lever is on the right-hand side, as well as by sketch of Webb Compound in April, 1889, number.

While reading of Sir Daniel Gooch, in the December, 1889, number, my mind wandered back to the latter part of the fifty's, and in fancy I saw the engines (loco.)—probably designed by Sir Daniel Gooch—at the Tredegar Iron Works, South Wales, where he served his time, and I wish it were possible to get a sketch of them as they looked then. The boilers were of an enormous size, being singleflued, with the fire at one end. The machinery was all on top of the boiler, close to engineer, as he stood on the footboard. It was quite a feat to reverse one of these engines. The cylinders were placed "slantindickler," and were coupled to the front drivers, four wheels coupled, the wheels being bald, and running on a flanged rail or tram road. These engines were whitewashed periodically, about once a month or so from the top of stack to the rail.

Perhaps some of the numerous readers of your paper can give you a little more information respecting these engines, their valve gear, etc., for they should certainly be classed as historical locomotives. I would like to write you more respecting the difference in the English practice of locomotive building, but know that there are many of your readers who would be able to do the subject justice, which I am afraid I could not do. Wishing you every possible success in your much needed venture. DAVID REES.

Macon, Ga.

[Our remarks about English locomotives with reverse gear on the left side were made upon the assurance of many English engineers, who say it is done because the engines run on the left-hand track on double-tracked roads. We have drawings and photos of modern engines on the North British road, showing reverse lever on the left side, also a photo of two classes of locomotives on the Great Southern & Western Railway, of Ireland, with left-hand reverse gear. Also engravings of a tank locomotive for suburban work on the London, Brighton & South Coast, that is a left-hander. We also have a picture of a 6-wheeled "goods" engine built in '82, on the London & Northwestern, with screw reverse on left side. There are, no doubt, many locomotives in England with reverse gears on the right side—they don't seem to have any standard rule, as we do here, each road meeting its own conditions.]

About Screw Cutting.

Editor The Locomotive Engineer:

I have been reading your paper, and I thought I would try my hand explaining screw cutting.

I have worked in several shops, and I found that most of the workmen, and even some of the foremen, did not know how to figure out a set of change wheels.

The easiest method I ever saw is to multiply the pitch of the thread to be cut by the number of threads to the inch on the lead screw, and then multiply the product by any number to bring it to the required answer, according to the change wheels.

To find the pitch of any complete screw, take the number of threads to the inch, and place one above it. For example; the screw is six threads to the inch, place one above the six equals one sixth the pitch; one thread is one-sixth of an inch.

Where the screw has a fraction, as 2½ threads per inch, reduce to an improper fraction and invert it. Example: 2½ reduced $\frac{5}{2}$ inverted, $\frac{2}{5}$, the pitch.

When the thread is one to every one, two, three or four inches, the exact pitch is given. Then the foregoing rule is just the reverse, thus, $\frac{1}{1}$, $\frac{2}{1}$, $\frac{3}{1}$ or $\frac{4}{1}$.

And if there is a fraction annexed, reduce to an improper fraction, thus, 3½ pitch = $\frac{7}{2}$, 8¼ = $\frac{33}{4}$, 2¾ pitch = $\frac{11}{4}$, etc.

Find the number of threads per inch to be cut, and then find the number of threads on the lead screw per inch, and multiply the pitch of the screw to be cut by the number of threads per inch on the lead screw.

Example 1.—Find the change wheels to cut five threads to inch with a lead screw four to the inch. The pitch is $\frac{1 \times 4}{5} = \frac{4}{5} \times 6 = \frac{24}{30}$, 24 on spindle, and 30 on lead screw.

Example 2.—Required the change wheels to cut six threads to inch, with lead screw two to inch. The pitch is $\frac{1 \times 2}{6} = \frac{2}{6} \times 10 = \frac{20}{60}$, 20 on spindle, and 60 on lead screw.

Example 3.—Find the change wheels to cut 2½ threads to the inch, with lead screw six to inch. The pitch is $\frac{2 \times 6}{5} = \frac{12}{5} \times 5 = \frac{60}{25}$, 60 on spindle, and 25 on lead screw.

Example 4.—Required to cut a thread to every one inch, with lead screw two threads to the inch. The pitch is $\frac{1 \times 2}{1} = \frac{2}{1} \times 20 = \frac{40}{20}$, 40 on spindle, and 20 on lead screw.

Example 5.—Required to cut a thread to every 2½ inches, with a lead screw two to the inch. The pitch here is $\frac{5 \times 2}{2} = \frac{10}{2} \times 10 = \frac{100}{20}$, 100 on spindle, and 20 on lead screw.

LEWIS CORYELL.

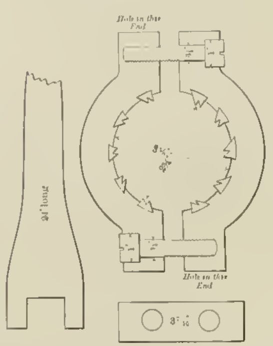
Marshalltown, Iowa.

Details of Hand-Turner for Crosshead Pins.

Editor The Locomotive Engineer:

I have received letters from the West asking for more details of our tools for truing off wrist pins than what you gave in your general description, and if you think it worth while you can publish enclosed sketch.

We have two sizes; this is from the largest one. I had the body pieces forged from soft steel. After planing them up, drilled and tapped for the screws; the heads of the screws are let in to the pieces to get them out of the way, and slotted to use a screw driver. Before boring them out we put two blocks about ½" thick between them, true them out and square them up $\frac{1}{32}$" narrower than the width of the wrist pin space; this allows the cutters, when finished, to project $\frac{1}{64}$" on each end, and this allows for truing out the corners.



I plane the places for the cutters dovetailing, and turn them out the right size—which, on this tool, is 2⅝" diameter—then mark them for the cutting teeth, drive them out and plane out the teeth. I make two teeth on each cutter, as I have found they work steadier than with one tooth.

To turn this tool we use a wrench made like sketch, drilling two holes in one end of each piece, to receive the prongs of the wrench. One of our men trued off two wrists a few days ago, without taking them out of the guides, in about five hours; they could have been done quicker if they had been taken out, but that would make it necessary to set the guides again. WILLIAM FOSTER.

Providence, R. I.

A Good Suggestion from a Blacksmith.

Editor The Locomotive Engineer:

I have read your paper since the first number was published. I like it—it is fair. In it I occasionally meet or hear of some old friend. This is always a pleasure, and would be increasing three-fold did your paper come weekly instead of monthly. I am not an engineer nor a fireman—only a blacksmith—maybe it is outside my business to write you, but you write of the blacksmith shops you visit, and I have caught on to ever so many *kinks* that you tell about; they have been worth the cost of the paper several times over.

I am chock full of respect for "trusts." Seems to me a man don't amount to much if he ain't in one. Last fall I went (by invitation) to the opening exercises of the Brotherhood of Locomotive Engineers Convention. Big trust, that. They didn't have to toot their own horn, either. One gentleman got up to speak, and somebody who sat next to me said he was *Meek*, but he didn't talk that way—told the men what their trust had done for them, and said that there was lots of room for further improvements.

Everybody listened, and, if any one felt *Meek*, you can bet it was not the speaker.

No sooner had this gentleman sat down than up *Chotes* a gentleman tall enough, if he were filled out, to weigh a ton. He kept pretty well on his own road—*broad gauge*. He was a regular pointer, you had no trouble to see a point when he made it.

Seems to me that nothing great is attained in this world that has not personal selfishness and improvement for a foundation.

We see master mechanics' associations, master car builders' associations, societies of mechanical engineers, etc. They are all working for the best interests of the roads they represent, by advocating a *uniform* standard of work.

They are encouraged by railroad managers, and yet who stops to think that, if most of these gentlemen were to prepare plans for a simple tool or complicated machine, about the first thing they would do would be to prepare drawings for the necessary forgings? Much of the future value of the tool, or success of the machine, would depend on the proper forgings of the parts. There are few, if any places in the mechanical department of a railroad where money is spent faster than in the blacksmith shop. How can a part be saved? The days are past when, in order to be a good smith, you must weigh 200 pounds—*kinks* have taken the place of surplus flesh.

So, if we are to save, we must adopt and use the best *kinks*. How are we to get them? Simply by going where they are, look them all over, and start back with a determination to improve them if possible, but to use them anyway.

I think I hear some one say, "Where would you go to see the best?" I do not hesitate to say the shops of the Pennsylvania Railroad are where most can be learned—they have a thorough system. Five years hence, if Mr. Cushing remains in control, I should expect to say the Union Pacific's new shops at Denver or Cheyenne. Perhaps in the future railroad managers may deem it economy to advocate a society of foremen blacksmiths.

Should they have doubts as to their ability to talk intelligently on matters pertaining to their business, they would be quickly removed by an hour spent with Mr. Cook, of the Altoona shop; Mr. Green, of Renovo; Mr. Stewart, of the Illinois Central, Mr. McPherson, of the Northern Pacific, Mr. Judy, of the Fort Wayne shops; and, with all respect to the other foremen along the Pennsylvania road, I think Mr. Judy's shop just a little ahead of any for practical kinks.

All this would take time, and, until something of the kind materializes, will not some of our superintendents of machinery and master mechanics—the progressive ones, I mean—occasionally send their foremen away to *look* for *kinks?* If, in the year following, the extra amount of work turned out does not doubly pay expenses of trip—well, if it don't, they need another foreman, that is all.

Like my friend John Alexander, I am growing old, would not expect to derive much benefit from such a society—then why advocate its formation? Simply this: I should like to see the services of a class of men with whom I have labored many years more fully understood and appreciated, and, as a consequence, better paid. It will not be necessary, I hope, to use a magnifying glass to see where the selfishness comes in here.

A RAMBLER AFTER KINKS.

Denver, Col.

[That a society of foremen blacksmiths would be a grand good thing both for the men and the roads, there can be no doubt; that trips about the country, visiting shops, would pay for all foremen—blacksmiths and every other kind—there is also no doubt. But it will take time to bring about these reforms, and, in the meantime, all are invited to use the columns of THE LOCOMOTIVE ENGINEER to trade kinks. The writer of the above communication is not behind the procession in the use of kinks. Sketches and descriptions are in order.]

Device for Turning Crosshead Pins, and Other Work that Cannot be Turned in a Lathe.

Editor The Locomotive Engineer:

I send you herewith blue prints of a lathe attachment for turning up solid pins in crossheads, boring out driving-boxes, and such other work that cannot be revolved in a lathe.

It consists of a loose pinion shown in detail at *a*, Fig 6, attached to the live center of the lathe by a bushing *b* screwed over the center so as to be used as an arbor for the pinion. A gear wheel or segment *d*, as shown in Fig. 1, meshing into the pinion fastened to the lathe face plate by stud *e*, Fig. 1. The face plate is secured to shear of the lathe by a plate *e*, with one or two bolts, so as to make it firm.

The pinion of the back gear is to be taken out or shifted so as to enable the back gear to be the driver

Extending the shaft of said gear to the inside of face plate by a socket, *f*, Fig. 4, with a crank attached to the same, it would leave nothing more than the well-known Pitman *h*, Figs. 2 and 5, to make the motion complete. To adjust the stroke, have crank *g* slotted, and for adjusting the motion use the cone pulley on the lathe.

The crosshead is held between two clamps, Fig. 3, adjusted by set-screws. Slot *m*, Fig. 3, in each of the clamps, is to fit pin *a*, Fig. 6, which is firm on pinion, and by which the crosshead receives its motion, making as near a complete revolution as possible

In shops where there is no slotter, this device can be used to bore out driving box brasses, by using a boring bar, as shown in Figs. 7 and 8, using the device the same as for crosshead work. It is necessary, however, to make a short clearance space at *x*, Fig. 7, to allow the tool to feed and start.

We have used this device in the Fargo shops for the past six years with very satisfactory results.

O. G. BRETTING.

Brainerd, Minn.

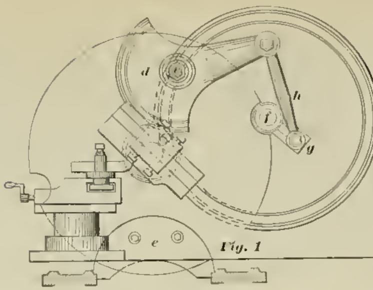


Fig. 1

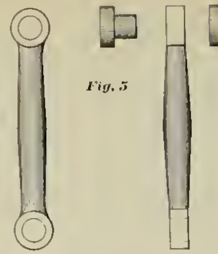


Fig. 5

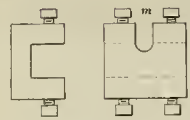


Fig. 3

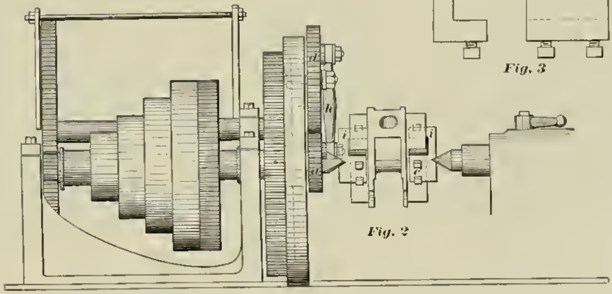


Fig. 2

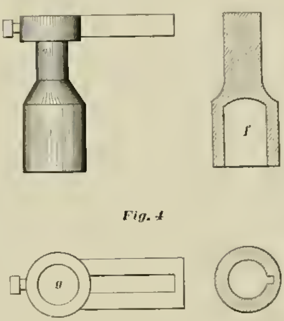


Fig. 4

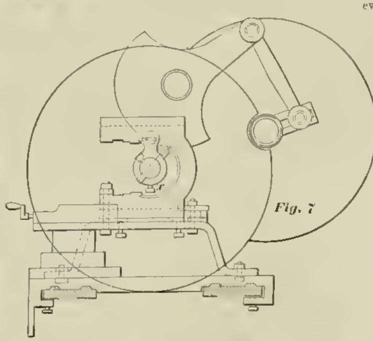


Fig. 7

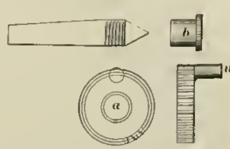


Fig. 6

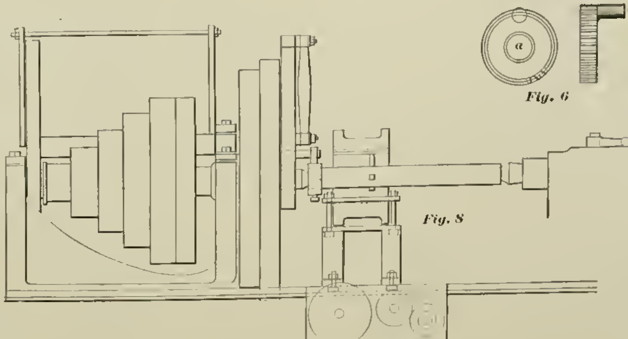


Fig. 8

DEVICE FOR TURNING CROSSHEAD PINS.

Wanted—Information About Traveling Engineers.

Editor The Locomotive Engineer:

In the last few issues of your paper there has been quite a heated discussion on the compensative ability of the present traveling engineer to a railroad company, between Mr. Phelan, of the Northern Pacific, and Mr. Campbell, of the H., E. & W T R R. Both gentlemen seem to have such extreme radical ideas, that, should they keep up the debate, there is no doubt the settlement of it would be by the havoc of war.

It seems as though Mr. Campbell wishes to exterminate the traveling engineer off the face of the earth, while Mr. Phelan's idea is that they are the only jewel in the railroad's diadem, and that every road should have one. In the last issue he sends a stinging rebuke to his majesty in the South, and accuses him of throwing the blanket over a title which would make the Pooh Bah of Japan cry with envy. The discussions are rather amusing, but how are we to find out which is right or which is wrong, when they are drifting from the green fields of discussion to the brickyard, "and throwing bricks at each other? There is no reason why the narrow gauge road does not give the gentleman of the South as much experience as the Missouri Division of the Northern Pacific does to Mr Phelan; either gentleman can easily get over their respective dominions in the short space of half a day, at the regular rate of speed. It is my opinion that the traveling engineers are nice fellows, they work both ways —good and bad, good when they never show up, and bad when they emerge from a neighboring cornfield to catch you serenely screwing down the "pop" to keep from doubling the hill, or, still worse, when you are back talking to some nice young lady friend in the Pullman, and the Con. ahead pulling the plug.

Still, it is a fact that, if the division M. M., general foreman and roundhouse foreman do not know the exact condition of the engines, and the ability of the engineers, there is no one on the face of the earth that does; that is why the traveling engineer is ornamental, but not useful.

When an engineer is hired he is examined on machinery by the M. M., on the time card by the superintendent or train dispatcher. He is then sent out, and it takes but a short time to find out whether he is incompetent or otherwise, without the assistance of a traveling engineer.

When the authority of the traveling engineer exceeds that of the division M. M. it is bad, when he is no mechanic it is worse.

I was on a certain road where the traveling engineer wore the crown jewel. One day I received a message from him telling me he had found an engine with the cylinder working 1½ inches, and wanted to know what to do. Well, who ever heard the like? I had a notion to wire him to put her in a box car and send her in. On going to the dispatcher's office I found she had been doing O. K. up to the discovery, when he side-tracked her; I ordered her in with her train. On examination I found the keys had worked out between the frames and cylinder, and caused her to work a little. I found out it was discovered by the eagle eye of the fireman, who reported it to the traveling engineer, hence the dispatch. As far as fuel and oil are concerned, we can easily determine economical or extravagant uses by engineers and firemen, by the monthly performance sheets. I shall conclude by saying I would like to see the principals debate this question from a mechanical point of view. I would like to have Mr. Phelan tell why the traveling engineer is a blessing to a railroad company—as some day I might have to hire one.

Oakland, Cal. W. D. HOLLAND.

Who is the Youngest Subscriber?

Editor The Locomotive Engineer:

I saw in the February issue of your paper an article headed "The Michigan Central Compound," in which the writer (G. L. Fleitz, of Detroit,) says that he is probably the youngest subscriber of THE LOCOMOTIVE ENGINEER. If he is, he is under sixteen, for that is my age, and I have been taking your valuable paper for six months.

San Francisco, Cal. WM. W. DAVIS.

Another Window Cleaner—Side Rods.

Editor The Locomotive Engineer:

We have an engineer on this road (N. Y. C.) who says, "There is no strain on side rods when engine is drawing train, provided she don't slip." This engineer has been running on this road about twenty years, and thinks he ought to know what he is talking about, and so do I. Can you enlighten him on the subject?

I send you drawing of window sweep used on our engines. Make bolt or thimble of six square brass, about ⅝ diameter, to go through sash; put nut on inside. Take 5/16" round steel and bend it like drawing, put a piece of rubber hose on end that sweeps the window, let rod extend through thimble far enough to take spring and handle; spring will draw the sweeper against the window.

We are using the new Westinghouse engineer's brake and equalizing discharge valve, and engineers say they are no good. I wonder if engineers on other roads have as much trouble with them as our engineers do. I would like to hear from some of them. W. F. REDVEA.

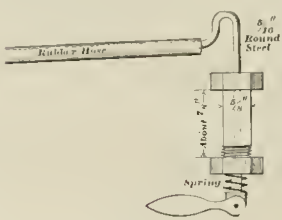
Syracuse, N. Y.

[If an engineer of twenty years' experience thinks the side rods do nothing except when the engine slips, it would probably take as long to prove to him that they do—life is too short to try. Engineers have had trouble everywhere because they did not understand the action of the new engineer's brake and equalizing discharge valve, and expected it to operate just as the old valve did. Where it has been explained to them, and they understand it, there is no complaint.]

Some More Kinks.

Editor The Locomotive Engineer:

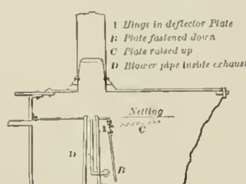
In the upper peninsula of Michigan, there are over 1,100 miles of track on which passenger trains are run, besides some double track, and all the sidings, ore tracks, branches to mines and logging roads, 300 miles more. Some who have never been in that country imagine it to be a wilderness, but it is a great and growing country, and some of



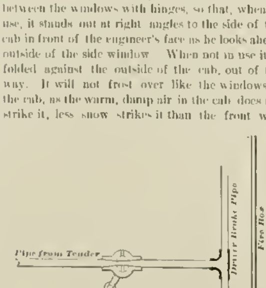
WINDOW CLEANER.

the finest mining machinery in the United States is hard at work there. The railroads are away up to the front in their locomotive equipment, there are a number of kinks in use there which may be new to some of the readers of THE LOCOMOTIVE ENGINEER.

A very comfortable thing used on the Soo Line



is a storm window for the engineer. It is a narrow sash, 6' wide over all, as long as the side window is high, with a pane of glass as large as the sash will take in and have strength to hold it. This sash is fastened to the strip in the side of the cab between the windows with hinges, so that, when in use, it stands out at right angles to the side of the cab in front of the engineer's face as he looks ahead outside of the side window. When not in use it is folded against the outside of the cab, out of the way. It will not frost over like the windows of the cab, as the warm, damp air in the cab does not strike it, less snow strikes it than the front win-



dows. You can get at it to clean the snow off without opening the front window, and it protects your eyes from rain and snow when you are looking out.

Some of the boys have a piece of looking glass in the top part of this storm sash, so they can see the tail end without looking around. That is handy too.

On some of the driver brake engines where the driver brake cylinders take air from the tender triple valve and reservoir, there is a plug cock under the deck in the air pipe, before it branches off to each side. This plug cock is connected in the same manner as a lazy cock in the feed pipe, so that it can be worked from the cab, where the handle is placed so as to be reached, without the engineer taking his eye off the track.

There is a ¼" hole drilled through the side of the shell and plug, like the "waste" the plumbers put in the side of a "shut off." The plug, after drilling, should be turned half round so the ¼" holes will not come together when the cock is open to allow the air to pass through to the driver brake. If the brake skids the wheels on slippery track, this cock can be shut with the ¼" hole toward the brake cylinder pipe, and the brake will release. The driver brake can be set after the tender brake sets, and released before the train brakes do, if so desired.

I do not believe in cutting out the driver brake—when it is in good order—under any circumstances, but some have to do it *they think*, and it is a wise plan to have a good arrangement for doing this.

On the lower peninsula they have a kink or two worth trying also.

It is quite a job to take down the deflector plate in the extended smoke arch when you want to wash out, bore out the flues, or, in fact, do any work back of this plate. If it is located in front of the exhaust pipe it can be hinged at the top and lifted up against the netting when necessary, and fastened there while work is being done. There is a strip of angle iron riveted to the side of the smoke arch which the deflector plate is fastened to, when down in its place, by bolts with split keys. With this arrangement, after the lower edge of the apron is fixed at the proper height, where the engine will steam well, it will not be altered every time it is taken down and put up again after the old style. The D., G. H. & M. Ry. use this and like it.

Most of the blower pipes come up at one side of the exhaust nozzle so that the jet of steam does not go up the center of the stack; consequently it does not produce the effect it should. It is in the road of all the pipes and bolts, and about half of the time is not put up as it should be. This pipe can be in the center of the exhaust pipe casting either as part of the casting or a hole drilled through the partition between the two steam passages, and a ⅜" pipe screwed in from the top. If the exhaust pipe pattern is got up with a view to putting the blower pipe in the middle of it, it will not add much to the cost. The steam pipe can be screwed directly into an elbow in front of exhaust pipe, where it will make a tight joint, and can be taken out from the outside. A brass bushing will be needed where the wrought-iron pipe is connected to casting, or the threads will not come apart easily. CLINTON B. CONGER.

Lansing, Mich.

A New Valve Gear.

Editor The Locomotive Engineer:

Having bought your paper regularly from a newsdealer ever since its start, and considering the valuable information one gets from it, and feeling that perhaps anything new in the line of valve gear would be interesting to your readers, I send you blue prints of a valve gear invented by one of the engineers on our road—the Boston & Albany—H. R. Fay. It has not as yet been applied, but I believe, however, that arrangements have been made and contracts signed for an engine to be built within ninety days by the Portland Locomotive Works for the Complete Combustion Company of this city, and this valve-gear is to be put on; the engine will weigh about forty five tons; the boiler is to be a wagon-top, with this company's form of fire box, which has water grates high up, the front ends entering a water space bridge wall that drops from the crown sheet, the draught going in on *top* of the fire, and forcing the flame down through the grates and to the flues.

This motion accomplishes quicker port openings, with shorter travel of valve, does away with increase of lead on hooking engine up, or has a stationary lead, which is adjustable, it has but two more pins than ordinary link motion, but whose movement is shorter, consequently less wear; in case of breaking either hook, eccentric or strap, or even the link, by taking off broken parts engine can be run to destination.

It has two eccentrics; the main one, which moves fixed link under frame, connection being made from block in link with bell crank at top outside pin of rocker arm; the eccentric which moves this fixed link is always set blind. The reversing is accomplished by moving block in this link from one end to the other, as shown in cut. The fixed link is an advantage, for the reason that finer points of cut-off can be had than with the movable link, the lower arm of rocker is slotted; the movable block in this slot—connected with eccentric, which is set on pin quarter—can be adjusted by "gibs," or with a lever from cab if desired, this eccentric has a throw equal to lap of valve, and fully controls lead. It can be applied to any engine with ease, and the only objection which has yet been thrown at it is that it is not desirable that the lead may be in hands of the "runner," that is, if lever from cab is used. Some of our oldest engineers say that the same objection was made to link motions. The remedy is simple. A "gib" fastening the movable block in lower arm of rocker will overcome this, and, besides, can be moved up so as to take up for lost motion, and always keep engine square, even after long and hard wear.

This valve gear is composed of two separate motions, which can be operated independently or together. Fig. 1 shows valve gear in side elevation, in full gear ahead; Fig. 2 shows front view of cut-off shaft, 59, and arms 61 and 62; Fig. 3 shows side view of Fig. 2, making more plain slot 63 and block 64 in arm 62, eccentrics are set as follows: Cut-off eccentric 56 is set with main pin 76, and

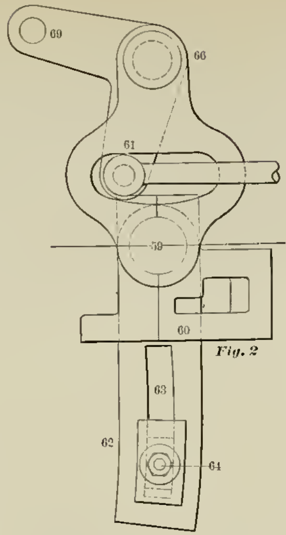


Fig. 2

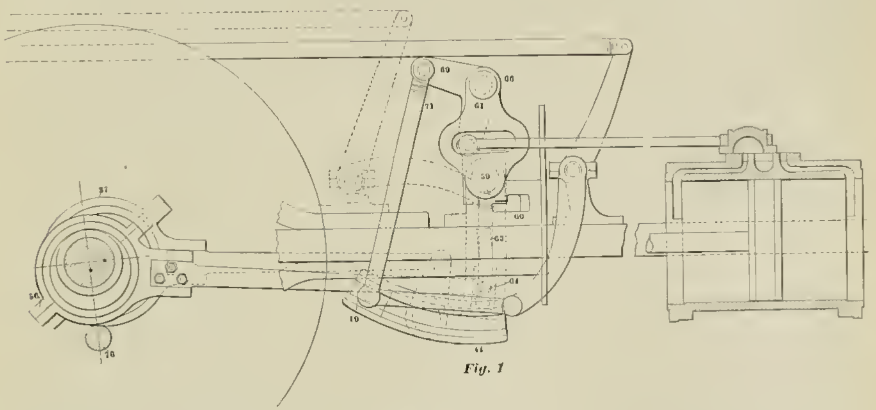


Fig. 1

has a throw sufficient to oscillate pin 66 to throw lap of valve over; the slot 63 is about five inches in length—as designed in this particular case—but could be varied according to dimensions of engine to be constructed. These dimensions were from working model designed on or from B. & A. R. R. standard passenger engine, 18 x 22" cylinder, 4½" travel of valve, 1" ports and 2½" exhaust port, ⅞ outside lap. Main eccentric 37 has throw to give desired travel to valve, giving rocking motion to link, whose movement is kept central by shaft and rocker arm 42, Fig. 2, this motion is communicated to bell crank 69 and 61 by means of rod 71 from link block 46, this eccentric 37 is set a little back of quarter, behind main pin 76, say at angle of 92 or 93 degrees, practically on that quarter.

By a lever in cab, block 64 can be moved in slot 63, or by doing away with such lever, and its rods and arms, making block 64 adjustable, it gives a constant lead, by raising 64, lead can be increased, when 64 is at bottom of slot 63 the lead is taken away, and the raising or lowering of this, either with lever from cab, or through its being made adjustable, fully controls the lead; also, if block 64 is raised and lead increased the lost motion of valve gear can be kept up with, and valves kept adjusted at opening points against general wear of gear.

It will be seen that this point of adjusting lead

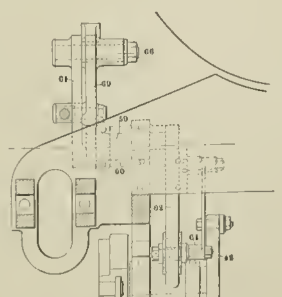


Fig. 3.

gives the engineer the advantage of adjusting his engine to all conditions of train grade or speed; he has full control of lead and cut-off, and width of port openings, giving a variation of 20 per cent. increase in expansion, and like reduction in compression over common link motion at short points of cut off.

Now with the two motions working together it will be seen that the radial center line of link is at right angles, or nearly so, with the center line of adjustable lead or cut-off eccentric motion, and it will operate engines with single valve, forward or back, in a more efficient manner than link motion as ordinarily used, with the advantages heretofore named; also a point in its favor, should eccentric, hook, or link, or any part of either motion be broken on road, take off broken part or parts, and the other motion will help the engine along, avoid long delays, and not making it necessary to block up or disconnect on broken side.

This valve gear gives quicker opening and closing of ports, and a point of rest when open, and is square at all points of cut-off, forward or back. This gear can be applied to any locomotive without any change, except the motion itself.

H. L. HOLMES,
Locomotive Engineer B. & A. R. R.
Boston, Mass.

[It is not our custom to show up untried devices, but as this one is ingenious, and shows thought, and is about to be tried we break the rule. A model of this motion shows nearly theoretically perfect valve handling. Now what it will do under steam is another thing.]

A Pennsylvania Railroad man says young men are selected as drivers of the locomotive on fast trains, because old men do not have the nerve to stand the strain of the terrible speed of these trains, and even the nerviest young man gets afraid of them after a while. Then they get to letting up a little in speed, the trains run behind time, the engineers are given other runs, and new men are put on in their places.—*Ry. Age.*

Speed affects some men after a while—they can't stand the strain; but fast running is natural for other men, and they get fat and old without getting enough of it.

It is a pleasure to be able to record a case where two labor organizations combine to make a social and financial success of their annual ball and banquet, instead of each having a small blow-out, and striving to see who can eclipse the other. We have before us an invitation to a ball, given on the evening of Feb. 14th, by Saratoga Lodge, No. 209, B. of L. F. and Champlain Div. No. 217, B. of L. E. Of course such an affair will be a success every time—how could it help it?

The foundations for the new elevated railroad in Chicago are going in, and the Keystone Bridge Co's. rolling mills are at work on the iron for the structure, with a contract to have one mile complete in March.

T. B. Twombly, after a service of more than twenty years, has retired from the position of Supt. of M. P. of the C., R. I. & P. Geo. F. Wilson has been appointed to fill his place.

LOCOMOTIVE ENGINEER.

THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS

The Difference Between Compression and Back Pressure.

It is perfectly plain from the arguments of a good many mechanical writers that compression and back pressure are too often confounded, and that compression is too often called back pressure.

Back pressure may be stated as pressure which opposes the movement of the piston by the live steam, therefore resulting in a loss of power that could, without this back pressure, be used in doing effective work.

Compression gives back to the piston as much power, on the return stroke, as was used in producing it. So long as the exhaust port is in communication with the cylinder in a working engine, there is back pressure on that side of the piston.

As soon as the port is closed, back pressure ceases and compression begins. Compression is simply the confinement of steam in the cylinder, and that steam compressed by the piston, driven by a greater steam pressure, on the other side, and by the momentum of the moving parts.

As all pressure on crank pins, while piston is within about two inches of the end of the cylinder, only produces excessive friction and does no work, compression is used to help equalize this pressure in arresting the moving parts; it supplements the lead by filling the clearance with a pressure nearly as high as the steam chest pressure, and saves loss in cylinder condensation by keeping the walls of the cylinder heated.

As action and re-action are equal, the compressed steam will give out, in effective work, as much power as it took to produce it, less the friction, which is probably more than paid for by the saving in heat before mentioned.

Unless the compression causes a greater pressure than that in the chest, it is advantageous, and necessary, especially at high speeds. The great trouble with those who have tried to improve the link motion for locomotive use, has been that they have confounded back pressure and compression, and have tried to produce a gear that would do away with both. The more back pressure is reduced, the better.

When compression is taken away (and you can get a card with a square heel on it) something must be introduced to do its work—in reducing the shock and friction at each end of the stroke—live steam will have to be used to re-heat the walls of the cylinder, initial pressure will be reduced, larger water tanks be needed, and steam shovels on the tenders to do the firing.

Union Meetings—A Suggestion.

In a recent conversation with a locomotive engineer, of more than average intelligence, the subject of union meetings was brought up.

"We want to have one here this spring," said he, "but I would like to see it turn out something beside a picnic and a love feast, but I don't see just how we can bring about a change, or what change is desirable." There is food for considerable discussion and thought in those few words. The writer is strongly in favor of the union meetings, even as they are, it is a rest for the men who can attend, gets them out of the rut, and gives a new lease of life, but, like most of those who have taken an interest in these meetings, do not see so very much good that can come from them as now conducted, other than that of a social nature.

Why would it not be a good idea for the engineers and firemen to combine their forces and make a new departure in the union meeting business? Or, if this is impractical, let each order hold meetings of their own.

We hope we do not go beyond our limits in offering a suggestion or two.

Why not district the United States, say the New England States, into one or two districts, New York, Pennsylvania and New Jersey into another, and so on, making districts any convenient size. Then hold regular union meetings, say twice a year in each district.

Hold two-day meetings, and a morning and evening session each day.

There is bound to be some question that is more or less local and of concern to the order—let these be discussed and disposed of at the first setting, all speeches glorifying the men or the order left out.

At the first evening session admit members with their ladies, have a neat ten-minute speech or two, a poem by Shandy McGuire, or some other poet from the ranks, and a general social, good time.

For the second morning have a discussion; subject chosen at one meeting for the next. Let the subject be one that concerns the relations of the engineman with the companies, and have men appointed to investigate the official side of the argument, and present the case from that side. Three speakers on a side, limited to twenty minutes or half an hour each, would make the matter interesting. After the discussion or reading of the papers let the audience ask questions or make remarks.

In this discussion men would only be talking to the members of the order, and men in their own walk of life, and no embarrassment would be felt. Bulletin orders, new rules and time card changes could be well ventilated this way.

On the second evening again admit ladies, and have a short lecture on some subject tending to make us more familiar with the mechanics of our trade. One time a talk on combustion and the laws of heat, the next on valve motion, using a model and explaining how to set valves, etc. Again, something about friction, the indicator, air-brakes, injectors or any other subject.

Plenty of men will be glad to volunteer to give these lectures, the makers of many of the devices will be only too glad to send men with proper models to make speeches. Such meetings would be of interest, they would rest, amuse, and at the same time tend to make better engineers and firemen of us.

Railroad officials would be only too glad to help in these meetings in the way of transportation; there need be no expense, except, perhaps, individual hotel expenses; any lodge room will do for the meetings; there need be no fund, no officers, and we have not the least doubt but that all would thoroughly enjoy and profit by them.

With something like this in successful operation, our orders would have something to show that would go to prove that brotherhood men enjoyed educational advantages that others could not enjoy, and therefore were better engineers and firemen than others.

The plan here outlined is crude, but it is well worth thinking about.

Watch Inspection—A Fair Plan.

As the complaint comes up regular from one place or another that officers of the companies are obliging the engineers and conductors to have their watches inspected by some certain watchmaker—or rather watchseller—appointed by the aforesaid official, it is suggested that the time has arrived for a general understanding of the rights of all in this case.

There are many of these plans that, on their face, are plainly money-making schemes that ought to be killed at once. On the other hand, many of the plans proposed for watch inspection have been with the good of the service in view, and these should not be killed in order to get rid of the first species. The general plan is to oblige the men to have their watches inspected by some certain person, and their good running condition certified to once in six months, for which the men have to pay from 50 cents to $1 fees. On all roads the men own their own watches, and use them in the service of the company, and these watches ought to be of a high grade, and in good condition, but just what that grade or that condition ought to be, varies with the men, and is liable to be very wide in its range.

Absolute safety, uniformity and accuracy will only be accomplished when the companies own the watches, and issue them the same as running orders, and wound and set.

This change would cost the companies considerable money, and is therefore not liable to be adopted.

Taking the next best plan, why would not the following rule be fair? Where inspection is ordered by the companies, and no work done to the watches, the companies to pay for the inspection. Where the inspection is ordered, and the inspector agrees to clean and keep the watches in running order—except breakages—the men to pay for the inspection. In one case they would be receiving something in return for their money, in the other, nothing.

The property of the corporations, and the lives of the public and the employes depend on the quality and condition of the timepieces used, and they should be the best. But when it comes right down to the right and wrong of it, there would be just as much reason in the railroad companies demanding that the engineers should furnish their own engines and keep them in repair. The watch is on a smaller scale, and we are used to it—that's all.

Prejudice.

The poet who wrote:

> "A sea horse is a sea horse
> When you see him in the sea,
> But when you see him on the land,
> A land horse then is he,"

very fully defined the prejudice with which we look favorably or unfavorably upon the very same things under different names or under different conditions.

The entire American people are terribly prejudiced against street locomotives, or dummies.

Street locomotives are now built that are almost noiseless, entirely smokeless, and are handled with greater ease, can be stopped with as much promptness and started with less shock than can horse cars, electric cars or cable cars. They are able to run on ordinary track, and can be operated cheaper than other power systems of surface travel in cities.

The old bugaboo that they scared horses has long been obsolete; there is no noise, escaping steam or smoke.

They look much as any other car does, and have not quite so good a chance to run over and kill people; but you suggest dummy locomotives, and the entire population protests. Why?

They will permit the stringing of high tension wires for the electric railway, whose cars are just as dangerous about running over people, are just as liable to scare horses, and expose from one end of the line to the other a live wire that it is death to touch, and one that is liable to be crossed by innocent telegraph and telephone wires, and cause fires or deaths.

These same people will let their children play in the streets along which all kinds of heavy trucks are rumbling with horses at a trot. They look without fear at great catamarans, under whose gigantic frames are swung iron or granite columns tons and tons in weight, they are drawn up hill and down with no sign of a brake—the people are used to them.

Cable cars gather in their regular quota of dead and maimed, the slot catches the calks on horses' shoes and breaks their legs—but it's all right, the people do have steam engines in the streets, and are happy.

If dummies were used, men trained to handle them intelligently would have to be employed, and care thus increased. Electric and cable cars are to all intents and purposes locomotives.

There is not one single valid argument against modern steam motors in our streets—prejudice alone keeps them off.

English, German or French prejudice is funny or ridiculous, but American prejudice—well, that's different.

Air-Brake Practice.

Some time during this month there will issue from this office J. E. Phelan's book on "Air-Brake Practice." The articles that originally appeared in this paper have been rewritten and revised, and several new chapters added. There are rules for figuring the power and leverages of driver brakes, as well as for all kinds of brake rigging.

All the rules and formulæ have been verified by the Westinghouse Co. as correct and up to date. The work will be neatly bound in cloth, with a flap, so that the book can be carried in the pocket. There is a pocket in the cover where plates of all the brake appliances are illustrated. The plates can be taken out, laid on the table or hung upon the wall for better examination. The engravings are very large and clear, being new ones for this work, and every part of the air-brake system is illustrated both in perspective and detail.

As the work is written by an engineman, for enginemen, it stands to reason that it should be clear, to the point, and couched in such language as they can comprehend. It will, no doubt, be the leading work on this subject, and destined to clear up many a mistery now tangled up in the brains of the men and the air-brake appliances in use.

New Clothes.

The editorial department of this paper has a new suit of rooms—one suit. Haven't moved out of the building, or anything like that, but made a new place out of the old—like a boy's new pants made from the cast-off pair of his father's. Since getting into the new den the walls have been adorned by the arrival of a handsome framed photograph of a locomotive from the Baldwin, Dickson, Rhode Island, New York and Richmond Locomotive Works, while the Brooks donated three, which, with the Pittsburgh that we had, makes quite a roundhouse of the place. All we need now is a switch engine to have a full band. When we get that, and the windows cleaned, the editor is going to wash his neck, put on a clean collar, and have his hair cut. Then the whole concern will look like the general superintendent's special engine on dress parade.

ASKED & ANSWERED.

(11) C. S. C., Madison, Wis., asks.

Suppose the Southern Pacific road could utilize the hot springs on its line for feed water for their locomotives, what would they gain, using 150 pounds pressure, provided the water was 180°, where it is now 60°? *A.*—They would gain the amount of heat required to raise the feed water 120°. The total heat units in one pound of water, at 150 pounds pressure is 1223.5; the water now contains 60 units, leaving 1163.5 to be imparted. By using the feed at 180° we will gain 120 units, which is just about 10 per cent. of the whole; this is providing no heat is lost in handling—which, of course, there would be.

(12) Stoker, N. Y., writes.

Please answer this question, and assist a stoker. I am firing for a man that wants the blower put on when he shuts off; he claims, if the blower is not put on, that the black smoke goes to the cylinders. Now, what I want to know, does it, or, if it does go to cylinders, does it do any harm? *A.*—When the engine is drifting, the tendency of the pistons is to pump the air out of the chest, and discharge it through the nozzles, but this is comparatively slight. When an engine is reversed while running, the tendency is to pump air through the nozzles and store it up in the chests and steam pipe. Smoke would help gum up the oil, and cinders would cut.

(13) A. E. A., Albany, N. Y., asks.

What is the Sweeney air compressor for air brakes, and where is it used? *A.* The Sweeney compressor is a pipe connection, with suitable valves, from the steam chests of a locomotive to the reservoir of the air brakes. It use is to supply a large volume of air quickly on mountain grades, and to handle the brake in case the air pump gives out, or cannot be made to supply enough air. It is operated by opening the valves and reversing the engine, allowing the pistons to pump air back into the brake system. It is a very cheap device, and an additional safeguard on mountain roads. It is in use on the Central and Southern Pacific systems.

(14) C. C. W., Ottawa, Ill., says.

I haven't been able to find out the function of the little reservoir under the engineer's seat, and connecting with engineer's brake valve. *A.*—The small drum under running board is to increase the area of space over piston in the engineer's brake valve. With the new valve, this little drum is a sort of sample case; the engineer knows just how big it is, and what pressure and volume of air it contains; when he wants to set the brakes, he lets out a given amount of air, that he can see and feel, and virtually says to the new equalizing valve, "about that much," and the valve lets out from each car just that much *pressure*, regardless of how many cars there are in the train.

(15) "On Time," Los Angeles, Cal., asks.

I want to secure a license as locomotive engineer. Can I do so by correspondence? If so, to whom will I make application? I have read and heard a considerable on this subject. I also think it is one that should interest every steam user, for it is a noted fact that our country is getting overrun by "stoppers and starters," that call themselves engineers, and will work for half pay, to the detriment of true and honest men. *A.*—"On Time" says he has not been on a locomotive for some time, and we have no doubt of it. We know of but one State where locomotive engineers have to have government licenses, and that is Alabama; and, so far as heard from, they do not send them out by mail. The best license that can be had is a promotion on merit by the officer in charge of the motive power of a railroad, and that promotion endorsed by most of the men on the road, who are not afraid to risk their lives on the ability of the holder of the license.

(16) Young Inventor, Cincinnati, O., asks:

1. How many locomotives, or about, are there in daily use in the U. S. A? 2. How much does the fuel cost the railroads to run a locomotive on an average per 100 miles? 3. What does a locomotive cost the railroads when they are bought new, both passenger and freight? 4. About how long does a locomotive last—that is the life of one? 5. About how many miles is a locomotive required to run a day? *A.*—There is no accurate data on any of these subjects. 1. There are about 32,000 locomotives of all classes in service in the U. S. 2. Fuel is as cheap as $2 per ton in some localities, and as high as $14 in others. 3. The average cost of locomotives, averaging all classes, for the past year has been about $8,700. 4. Some parts last 20 to 30 years, depending on the service; boilers go from 15 to 20, with renewal of fire-box every 5 to 8 years; frames generally last the longest. 5. The widest possible difference, but the average of a very large per cent. will be about 100 miles.

(17) E. H. P., E. St Louis, asks:

Please tell me why the engine I am running will pull 13 loads up Ozark hill in the fourth notch on the quadrant, and a full throttle, and will only pull 13 loads when she is in the corner. The engine is a common 10-wheeler 19 × 24, 4½ foot wheel, pressure 150 pounds to square inch, built by the Rome Loco Works. There is nothing in the world wrong with the engine; she is in first class fix. What I want to know is, why will this engine pull as much hooked back to the fourth notch as she will in the corner, full throttle. *A.*—You do not state the speed, but we assume that it is moderate; when the engine is working in the 4th notch she admits steam earlier, gets all she can use and have time to get rid of it. You must remember that the steam has to get *out* as well as to get *into* the cylinder. In full stroke steam follows almost to the end of stroke before exhaust takes place, then the steam admitted to the other end of the cylinder has to work against the back pressure in forcing the steam *out* on the other side of the piston. In moving very slowly, like a start, the steam has *time* to escape, but at any speed at all, is has to be forced out. This shows the efficiency of the link motion; the steam you use at the earlier cut-off is almost entirely used in pulling the load, while a large per cent of that used at full stroke is lost in getting rid of the excess steam used on the other side of the piston.

(18) E. O., Wilmington, Del., asks:

Please give a simple rule for getting the horse-power of a locomotive, and also of giving the size ports to any size cylinder. *A.*—It is customary to allow half the boiler pressure for the mean effective pressure, which is the average pressure from the beginning to end of stroke. The following rule is used for any engine, and where used for a locomotive the result should be doubled, because a locomotive has two cylinders. *Rule.* Multiply the mean effective pressure in pounds on a square inch of piston by the length of stroke of piston in feet, multiply this product by the area in square inches of the piston, and again multiply this last product by the number of strokes made by the piston in one minute, and lastly, divide this total product by the 33,000, the quotient will be the indicated horse power. Probably the following formula will help to impress this rule on the memory: Let $I\,H\,P$ stand for indicated horse-power; P for the mean effective pressure in pounds on a square inch of piston; L the length of stroke in feet; A the area of the piston in square inches; N the number of strokes made by the piston in one minute. We then have

$$I\,H\,P = \frac{P\,L\,A\,N}{33{,}000}.$$

Here it must not be understood that the word *PLAN* has any particular relation to the horse-power of an engine, but the letters forming this word should simply be understood to be symbols of the factors which enter into the calculation; neither does it make any difference in which order we take the factors, but, placing them in the order here given, they form the word *PLAN*, which may help to impress the rule upon the memory. The divisor 33,000 stands for that many foot-pounds. An engine which raises 33,000 pounds through one foot in one minute is said to exert one horse-power. This unit of horse-power was established by Watt, and has been in use ever since. There is no set rule about size of ports.

(19) 59er, Minneapolis, Minn., writes:

A four wheeled coupled shifting engine, main rod connection on back drivers, breaks the left hand side rod, and forward strap on right-hand side rod. Engineer finds back end right hand side rod bolts badly sheared (and they finally have to be drilled out), so that it is impossible to take said rod down. How would you proceed to shop, three miles distant? 2. Can you furnish me a list of standard screw threads, or let me know where I can find them? *A.*—1. There can be no rule given for a case of this kind. Of course, if the side rods were down, the engine would be all right to run, and, as the right one can't be got loose from the pin, the only way would seem to be to get the loose end to swing by a rope, or over some guide, either that it finds itself or is found for it. We remember a case of broken side rod on an eight-wheeler, where about five feet of the rod on the back pin found its way through the planking of the running board ahead of the engineer's seat. Just how it got there could not be seen; for, in moving the engine a complete turn, it would not come out by eight or ten inches, and the engine was finally run to the shop with it dancing up and down in the cab. Of course in cases of this kind, the engine must be run very slowly. 2. The standard screw thread most used in America—known as the Sellers standard—was recommended by the Franklin Institute, December 15, 1864, and has been adopted by the United States Navy, the Master Mechanics' and the Master Car Builders' Associations, as well as most of the makers of screw-cutting devices, locomotive works, etc. In this screw the angle of the thread is 60°, and the thread is flat on top, and at bottom 1/8 of the pitch. The standard sizes are as follows:

Diam of Screw	Threads per Inch	Diam at Root of Thread	Diam. of Screw	Threads per Inch	Diam. at Root of Thread
1/4	20	.185	2	4 1/2	1.712
5/16	18	.240	2 1/4	4 1/2	1.962
3/8	16	.294	2 1/2	4	2.175
7/16	14	.344	2 3/4	4	2.425
1/2	13	.400	3	3 1/2	2.628
9/16	12	.454	3 1/4	3 1/2	2.878
5/8	11	.507	3 1/2	3 1/4	3.100
3/4	10	.620	3 3/4	3	3.317
7/8	9	.731	4	3	3.566
1	8	.837	4 1/4	2 7/8	3.825
1 1/8	7	.940	4 1/2	2 3/4	4.027
1 1/4	7	1.065	4 3/4	2 5/8	4.225
1 3/8	6	1.160	5	2 1/2	4.480
1 1/2	6	1.284	5 1/4	2 1/2	4.730
1 5/8	5 1/2	1.389	5 1/2	2 3/8	5.038
1 3/4	5	1.490	5 3/4	2 3/8	5.203
1 7/8	5	1.615	6	2 1/4	5.423

The Whitworth standard, used mostly in England, has top and bottom of threads rounded. Angle of Thread, 55°, depth of thread equal to the pitch of the screw.

On the Lehigh Valley.

(Editorial Correspondence.)

Last month I took a hurried look around some of the division shops of the Lehigh Valley Railroad.

The Lehigh Valley road, with leased lines, and those controlled by it, comprises 804 miles of road. But the trains of this company run over the tracks of other roads as follows: 50 miles of the Pennsylvania, 15 of the N. Y. C. & H. R., 188 of the N. Y., L. E. & W., and 21 of the Central of N. J., making in all 1,078 miles of track covered by their trains. The road proper was first chartered as the Delaware, Lehigh, Schuylkill & Susquehanna R. R. Co., in 1847, and under its present name in 1853. It is comprised of no less than thirteen different lines and branches, the longest 65, and the shortest less than two miles long.

It was the consolidation of this road with the Lehigh & Mahanoy road, in June, 1866, that gave the name to the Consolidation locomotive, the first of that popular class of freight haulers having just been completed by Alexander Mitchell, at Delano, Pa., and named "Consolidation" in honor of the event.

The L. V. road itself owns 160 locomotives, and over 42,000 cars, 27,000 of which are coal cars. The principal business of the road is anthracite coal, and in 1888 the road moved 7,050,147 tons, or 579,534,915 tons moved one mile, and at an average rate of one and a quarter cents per mile. The passenger receipts for that year were over $1,100,000, freight, nearly $2,200,000, mail and express, over $82,000, and coal, over $7,200,000—a total earning of almost $11,000,000, on an operating expense of but little over $7,000,000. So that you see the road does a big business.

I have explained before that there is no superintendent of motive power upon the road, each division master mechanic is independent, builds or buys his locomotives, as he sees fit, tries any experiment he thinks advisable, and tries to have his engines do better work and more work than the other fellow's.

There are all kinds of locomotives there, but there are very few poor ones. Most of the master mechanics were in charge of the motive power and machinery of the different roads before they were consolidated, and have under their care an endless variety of mining, pumping and coal-breaker machinery not heard of on most roads.

DELANO SHOPS.

The shops in the little town of Delano, Pa., were the original shops of the old Lehigh & Mahanoy road, and were built some 30 years ago; they are of stone, and pretty well preserved. The engines are housed in two square houses, facing each other, but some distance apart; there is no turntable; the yard in front of the houses lets engines upon a **Y** on which they are turned; the road branches several ways from the town, and engines can be headed in any direction with little trouble. This arrangement is handy enough for the location, as room is cheap, and, in case of fire, all engines can be got out of the house and away; in these houses they put a sheet-metal cover or muffler on top of the stacks to prevent the fire from burning too fast; the fires are not banked nor holes made in them. Just enough opening is left at top of stack to carry off the gas.

In the machine shop there is a good assortment of tools, many of them new, and all at work.

In the erecting shop were several engines undergoing repairs, and one new passenger locomotive, a mate to the 443, illustrated in our November issue, just ready to come out. This engine has one of the variable nozzles shown on another page, the clear opening being 5 3/8 inches, single.

Solid bronze crossheads are used, and bronze liners on the inside of guide, the crossheads having babbited strips in them.

Solid bronze is used also for eccentric straps.

Cylinder castings have a valve seat about an inch and a half high, and wear out the cylinders without the use of false seats.

Most of the engines have one safety valve, with a releasing lever back of the gauge in the cab, then a Lynde encased pop is used for regular work; the pipe from this valve case extends back to the top of the cab, and has a **T** piece on it, with ends about a foot long; these ends are drilled full of small holes, making a very good and efficient muffler, and a very cheap one.

Some of the engines have one pump, and Little Giant and Sellers injectors are used, a lever reaching from lever of the left hand one across the boiler, so that both can be used by the engineer from his position.

At this shop no screw-globe valves are put on engines—all work with a lever.

There is a large drop-pit in use, that has been in service almost since the shops were built, and seems as good as ever.

A few engines have an extension about a foot long, but most of them are provided with cinder-boxes, set outside of the front end and between the frame, all using a straight, open stack.

Hard coal engines require a large fire-box, and all the boilers extend through the cab. A hinged seat then becomes necessary, and instead of boring the cab full of holes to fasten up hinges, a light, triangular casting is bolted to side of cab; in the two top corners are slots, larger at top than at the bottom, into which the iron ears on the seat drop; at the lower corner of the triangle there is a pocket or step for the iron brace that holds the seat up—on some of these a coil spring is used to lessen the wear on the rider's spinal column. These seats can be lifted off, repaired or replaced, without unscrewing anything.

Passenger engines have a front-end buffer that folds back on the draught iron when not in use. They take off the long air hose on front of engines, and put it away, as it is used only in emergencies.

Many of the side rods have a short key entirely within the strap, the full width of the brass, that is held against the tapered end of the rod by a set-screw in the strap.

All passenger locomotives are named.

This shop, like most of the others on the road, have recently built some freight engines with wide fire-box, for burning pea coal. These are Consolidation engines, with a fire-box extending over the wheels, like the Wooten; they have a grate area of 69 square feet, and run with a six-inch nozzle. The 100, just finished here, is as neat and comfortable a freight engine as the writer ever saw. On these engines all four pairs of wheels are flanged, and, although the road is a crooked one, they cut the flanges nowhere; the D., L. & W. have always run their Consolidation engines with all flanged drivers, without trouble, giving plenty of lateral motion to the forward and back pair of drivers, and shortening the radius bar to the pony truck, so as to let the forward pair of flanges get to the outside rail. These engines have a rigid wheel base of 15 feet. The back heads of these fire-boxes are flanged *out*, so as to be easier to take out fire box; they are fitted with the Weaver grate.

A separate shop is fitted up to do frog, switch and crossing work, a great deal of this class of work being necessary around the mines. They use a circular cold sawing machine here to cut off rails. Crossing work has to be very well done, is heavy work, and is a good deal of trouble to a shop. I have never been able to see just why such a shop is not turned over to the road master's department—it would save lots of kicking.

In the blacksmith shop, a very neat little spring trip-hammer, of home make, is used to weld flues, and it does very nice work, at the rate of 200 per day.

The car shop is small, and used chiefly for rebuilding. They have in use here a very efficient end stop, for car and tender journals; it is a round bronze plate, about 1" thick, the size of the journal; on its back are two lugs for a 5/8 bolt, which goes through the box sideways, holding the stop in place at the end of the journal. It is used on journals with a collar, and is well liked, saving end wear of brasses and heating of journal; the stop is easily taken out, can be put into an old box, and is not patented.

The division officers are housed in a handsome building near the depot, and a person sitting in the handsome rooms of Master Mechanic John Campbell, finished in quartered oak, and furnished to match, steam heated and Brussels carpeted, would not imagine that he was in one of the interior villages of Pennsylvania.

HAZLETON SHOPS.

No two shops on the L. V., are alike, or anywhere near alike; the shops at Hazleton were built long years ago, principally to repair mining machinery. Most of them are very old, dilapidated and unhandy, no two shops having floors at the same level, or roofs at the same angle; there are machine tools in the boiler shop, and boiler shop tools out doors, where there is room is the place that tools have been set up. They have, however, a very nice stone engine house, but the constant settling of the ground—the town is built over coal mines—has badly cracked its walls.

Within these old shops a great deal of machinery is housed, and a vast variety of work is done. No less than twenty distinct classes of machinery are built. Some very fine looking locomotives are turned out here, and several of them have Master Mechanic Clark's cut-off gear, where a separate eccentric works a cut-off valve on top of the main valve; these locomotives make as pretty an indicator card as a Corliss engine, but the road has no place to test such a gear.

In the shop there were a couple of new Standard engines, one little mining engine nearly completed—the 61st of their build—these little fellows have been all sizes from 7x16 to 11x16 inch cylinders, and for gauges, all the way from 36 to 52 inch.

A little further away, a very large double hoister, with cylinders 17x24, and proportionately heavy machinery, is in process of erection.

At another point, a large, plain, slide-valve stationary engine is being rebuilt to an automatic cut-off.

Here are mining pumps, many having parts made of brass where the iron rusts or is eaten out too fast.

At another point, crusher rolls for coal breakers.

A large foundry is operated, and all the chilled car wheels used are made on the ground. There is a separate room for setting diamonds in drill heads, for taking out a sample of rock or mineral far under the surface.

This work has grown little by little; it is not like the work on any other road, or any other part of this road, and practical experience in the place is necessary to successfully carry it on.

Master Mechanic Clark, who, like Mr. Campbell, came up from the footboard, has had charge here a long time, knows what is needed, what can and cannot be done. He has invented a great many appliances in all departments of the work; among others, a steam driver and tender brake; this brake is handled by a foot lever on the deck.

We noticed in the machine shop a 12" circular saw, running on an arbor between the centers of a lathe, and used for cutting off flues. The flues are clamped between two plates on the carriage, in the place of the tool post, and are fed up to the saw by hand. The lower edge of the saw runs in a tin dish of oil. Flues are cut off about as fast as a boy can hand them to the man on the machine. In the erecting shop they chip out the ribs in cylinder saddles, and make a joint by pouring in zinc.

SOUTH EASTON SHOPS.

The Easton shops are the largest on the road; the original shops were small, but the present plant consists of a dozen or more of substantial buildings of brick, built within the past ten years; they are large, but pretty closely crowded together. The grounds are enclosed by a neat iron fence, a separate building housing Master Mechanic J. I. Kinsey and his assistants. Grass-plots are kept up in odd places, and there are no piles of scraps or dirt about the yard or in the shops.

All the cars used by the company are built here, and the car shops constitute a large part of the plant.

If Wm. Mason could come back to us, and would visit South Easton, he would find there a Mason Locomotive Works, very little has been changed from his Standard 8-wheeler.

I believe Wm. Mason's locomotive of 20 and 25 years ago was nearer our best practice of to-day than that of any other builder.

Wm. Mason did not claim to be the originator of his locomotive; he was a mechanic of excellent judgment, and, before he built a single locomotive, thoroughly investigated the subject, and combined the best points of all the builders. He was one of the earliest advocates of "standard" parts. He made all his eccentrics, links, rockers, etc., one size; they were strong enough for all sizes of cylinders that he built, all main rods were of one length. In after years, when he was forced to build 10-wheelers, he just added to his 8-wheeler—put on a little more length of boiler, and another pair of wheels—ahead of that they were just like his 8-wheelers. John I. Kinsey does the same.

The engines built here are therefore alike; there are less patterns and castings required for repairs, and more uniformity of work.

Steam pipes are fitted to the side of chest; cylinders, many of them inclined, are bolted to a center casting; valve yoke is the Mason fork, the main stem going through a notch in back of valve, with cross-pieces both sides, links are suspended from above the center; Mason's fancy bell stand, headlight brackets, etc. Don't imagine these engines are behind the times; they do as good work, cost as little to build or repair, and look as well as any engines running into this city.

Seven or eight engines were in for repairs, and a new one was about ready to come out—they build one about every six weeks.

In the shops the tools and the floor are kept clean; the tools are conveniently grouped, and well served with cranes.

In making crossheads, they take the rough casting, and bore the taper hole for the rod; into this bore they force a mandrel, with a taper end, and lay this mandrel across a pair of V blocks on the bed of a small planer; a collar on the mandrel, just back of the taper fit, is just the width of the body of crosshead, the part that goes between the guides; if the planer tool is set to this no other measurements are necessary for that, then there is a little post behind the crosshead, and held in a slot of the planer bed, that is just the height the tool wants to stand to finish the wings of the crosshead; by loosening the bolts that clamp the arbor to the V pieces, the rig can be turned over, another little block sets it level and the piece is finished without a measurement being taken, or a caliper used.

Piston rods are put into the piston on a taper, but against a collar, keyed, and then are riveted down.

They have in use here a very handy device for handling valve-seat planer and chest lids. Since locomotives have got so big, and the covers so heavy, it is the work of two or three men to handle them, and when it comes to putting a seat planer on, there is hardly room for enough men to get around one to handle it. General Foreman A. Turner designed and built the handiest crane I have ever seen for this work. He took a 4-wheeled platform truck, with about 12-inch wheels, and platform perhaps 3x5 feet, and built a heavy plank box, about 2 feet high, on it; on the back end of this box he built a small iron crane—gas pipe standard—and an arm that would reach perhaps 4 feet; this crane is operated by a crank, located at base of crane, through gearing, and will lift 400 or 500 pounds easily; in the forward end of this box, which has a cover, he made a place to keep the valve seat planer when not in use.

Now, when they want to take up a chest and face a seat, one man can go and get the crane, planer and all, and take it to the roundhouse or back shop. All the tools he needs to take up the chest are in the box. He can lift the cover and the chest alone, take up his planer and set it, face off the seat, replace everything, and put the rig in its place without bothering anything or anybody else. If I had a shop big enough to have a valve seat planer, I should make one of those cranes. There is a splendid, large roundhouse here, but I was told the engineers have to take out and put in their own engines. Getting out is all right, but putting engines in house, where a large number are in service, causes men to lose a great many hours time, which ought to be paid for.

On the side of one of the shops, in plain sight, and perhaps 300 feet from the office building, is a station signal box, such as used on the road; this is used in testing men for color blindness, and is a correct and just test—in the open air and using the regular road signal—but I am told that they also rawhide men a little with the yarn test.

J. A. H.

The cost of removing weeds from the South Australian Government railroads is nearly £16,000 per annum. For over three years past the engineer-in-chief has been experimenting, and he has now had constructed a machine which will weed the broad-gauge lines effectively at the rate of four miles per hour. It is believed that £1,000 per annum will be saved to the South Australian Railways Departments by using the apparatus.—*Indian Engineer.*

All the different colonies of Australia, Victoria, New South Wales, and Queensland have different gauges of railroads, ranging from 3 feet 6 inches to 5 feet 2 inches. Efforts are now being made to adopt a standard gauge.

Simple Lessons in Drawing for the Shop.

BY ORVILLE H. REYNOLDS

FIFTH PAPER.

This paper will be devoted to the construction of simple figures, affording interesting practice and familiarizing the student with a few exercises which will be useful in the shop.

Fig. 16 is a mass of diagonal squares, to construct which lay off a rectangle any size; with the T-square draw horizontal lines and with the triangle erect perpendiculars to these lines, completing the outline of figure; lay off on left side, and base, any number of equal parts, say four, and with the 45° triangle draw diagonal lines, beginning at corner, and intersect points made on side and base. Reverse triangle, and draw to meet lines already made through points on side and base.

Construct the same figure as above, and at each point found on side and base, draw a horizontal and perpendicular line respectively, producing Fig. 17; this rectangle contains a series of 45° triangles. If, now, this were a piece of metal, and grooved with a V-shaped tool at each horizontal and perpendicular line, it would have a number of pyramids whose points would be at *E*, *E*, etc.

Types of this exercise in locomotive practice are found on the tops of steam chest casings, and also on running boards, when latter are made of cast-iron, the pyramid-shaped points insuring a high co-efficient of friction on the fireman's boots.

Draw an angle of 60°, and divide it on side and base as before, using the 60 triangle for the diagonals. Many designs, as equilateral triangles, hexagons, etc., may be formed, giving good practice in handling of triangles, as well as producing some pleasing combinations of geometrical shapes.

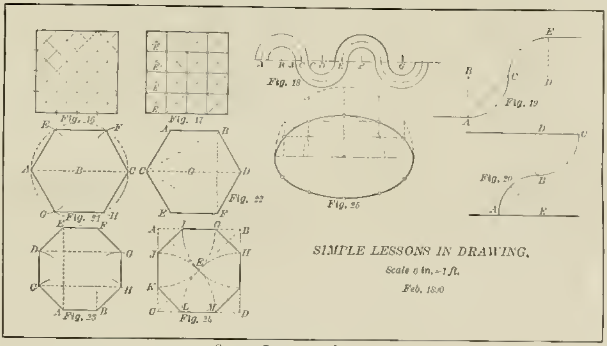
Fig. 18 is given for an example in joining of arcs; draw base line *A*, *G*, and describe a semi-circle *A*, *C*, with radius *A*, *B*. On the base line lay off radius *C*, *D*, equal to *B*, *C*, and with *D* as center, describe semi-circle on under side of the base line, perform same operation at *E*, *F*, from *F* as a center with same radius as before, but above the line, and the center line of the figure will be complete. Now lay off on each side of *C* half the width of figure as *A*, *C'*, and with radius from *D* to *A* and *C'* respectively, describe the semi-circles as shown. The successful production of this figure, simple as it looks, depends wholly on the care taken in joining the curves. Radii must be absolutely correct or the curves will not join smoothly.

Fig. 19 shows two parallel lines connected by a reversed curve made by two arcs of equal radius. Join points *A* and *E*, and bisect line *A*, *E*, at *C*; divide *A*, *C*, and *C*, *E*, equally by perpendicular lines, at *A* and *E* also erect perpendiculars to the parallel lines, then intersections *B* and *D* will be the centers from which to describe the arcs.

Fig. 20 is an example of a reversed curve of two equal arcs joining two parallel lines, when centers of the arcs lie on the parallel lines. Join the points *A* and *C*, and bisect line *A*, *C*, at *B*; then divide *A*, *B*, and *B*, *C*, into equal parts, and erect perpendiculars; the centers of the arcs will be at intersections *D* and *E*, with the parallels.

The same care in dividing the lines and locating the centers must be taken in the two last examples as in Fig. 18, if good results are expected. Figs. 19 and 20 are often met with in shop practice.

Fig. 21 shows the construction of a hexagon with the compasses. Draw the circle *A*, *C*; take radius *A*, *B*, and from *A* and *C* as centers cut the circumference at *E*, *F*, and *G*, *H*. Straight lines



SIMPLE LESSONS IN DRAWING

drawn from A to E, E to F, etc., make an inscribed hexagon.

Fig. 22 is a hexagon constructed without the compasses. Let A, B, be a given side, now the interior angles of a hexagon are equal to 120°, and the exterior ones are equal to 60°, therefore we may draw A, C, and B, D, with the 60° triangle. To find the length of the sides, locate the center between the lines A, B, and E, F, and through it draw C, G, D, with the T-square, this determines points C and D. Draw C, E, and F, D, with the 60° triangle, and the figure is complete.

An equilateral triangle may be formed by joining the alternate points on the hexagon, as shown by dotted lines, C, B, F, in Fig. 22.

To prove the construction of the hexagon, take for a radius the distance from the center to the points found, and set it off around the hexagon; if construction is correct the dividers will fall into each point.

In Fig. 23 we have an octagon, to construct this figure draw A, B; make A, C with the 45° triangle equal to A, B. At C, draw the vertical line C, D, and set off on C, D, the distance A, C, then draw D, E, with the 45° triangle to its intersection with the perpendicular line A, E. Determine H by a line through C, and intersect it by a line drawn with the 45° triangle from B; draw H, G, to the intersection of line drawn through D, and with the 45° triangle draw to F, when a horizontal line from E to F completes the octagon. This construction, it will be noticed, is entirely with the T-square and triangle; another method is to describe a circle, and step off eight points equally.

Still another and easier method of construction for an octagon is shown in Fig. 24. With the T-square and triangle produce the square A, B, C, D; draw the diagonals intersecting the center at E; from the corners A, B, C, D, with a radius A, E, describe arcs passing through the sides at G, H, I, J, etc.; draw with the 45° triangle through these intersections with the square, and the octagon is produced.

The next exercise is an ellipse (Fig. 25), and is constructed by describing two circles—one representing the major axis or long diameter, the other the minor axis or short diameter. Draw radial lines intersecting both circles, and from intersection of radii with circle representing the minor axis, draw horizontal lines. From intersection of radii with circle representing major axis, draw vertical lines, the crossing of horizontal and vertical lines gives points in the ellipse, which can be joined either by the compasses or a template of thin wood or cardboard, taking in as many of the points as possible.

The radial lines should be numerous, as the greater the number of points the easier will it be to join them smoothly, and make presentable figure.

It is not absolutely necessary that the exercises be finished in ink, they can be left in pencil if neatly done, but, as they will be milestones on the road of progress it would be well to ink them in, that they may be better preserved.

At Dickson's

At the Dickson Locomotive Works at Scranton they have a number of heavy passenger locomotives in process of manufacture for the D. & H. C. Co., and have just closed a contract for twenty-five with a new road now being built out of Scranton.

Some new wide fire-box stationary boilers have just been put up in these works. They are fired with pea coal, and the draught, aided by a blower, is regulated from the fire-room. These boilers are very large, and there is a stone pit, some eight feet wide and two deep, under the round part of boiler, then there are doors in the *front* of fire-box, from which to clean the fire. Thus there are no pokers, slice bars, clinkers or smoke in the fire room. All ashes are taken away from the pit without making any dirt, as there is room to store them and wet them down in the pit.

Locomotive boilers are here lagged with asbestos mortar, but band iron strips with projecting rivets are fastened to the boiler, and from these rivets wire is used to secure the mortar and bind it together.

These works are now making straight steam pipes in front ends, and saddles cast with steam and exhaust passages separated, like the D., L. & W. engines, described elsewhere.

Attention is here paid to getting the engineer's brake valve where he can reach it, something not generally done.

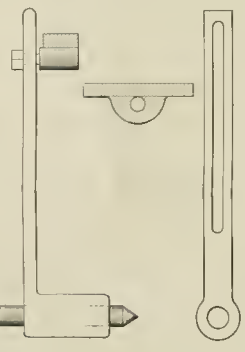
A big improvement in the quantity of scrap bar has been made here by putting all wrought scrap in a tumbling barrel, and taking off all rust and scale. Superintendent Devine says that, since this practice has been commenced, they scarcely ever lose a weld.

Valve-setting Kink.

At the shops of the Providence & Worcester road at Valley Falls, R. I., they use a very neat little kink in valve setting.

Instead of tramming from the wheel cover, guide yoke or frame to the wheel, they have a bracket that bolts on the underside of the running board, to which a tap bolt holds a slotted bar, as shown in cut; this bar carries at its lower end a nicely fitted prick punch. When this is placed over a wheel, and the point of punch brought down to the line drawn on the tire, it constitutes a tram, stays in place, and will show if the frame moves up or down on the box, though this is of little consequence.

When the point is just where you want it, a slight tap with a hammer makes a decent mark, where you want it. To insure against the device being



accidentally moved, a measurement is taken from a point on the arm below the running board to the board itself, and simply trying with a pair of dividers insures accuracy.

In a D., L. & W. Shop.

We have before mentioned some of the practices in the Scranton shops of the D., L. & W. road, but at every visit something new or different from average practice is found.

The D., L. & W. was one of the pioneer lines of Pennsylvania. Its motive power was early placed in the hands of a man of ability, and with ideas of his own, and the locomotives yet bear the ear-marks of that individuality.

The engines are all hard coal burners, have short fronts, and, most of them, diamond stacks.

The back end of boilers—with fire-box on top of frame—are inclined so as to make the tubes through the back head that hold up the grate bars, between the water grates, straight. Water grates must be inclined to secure a circulation, and many years of experience here have shown that an inclination of one and a quarter inches to the foot gives the best results.

A great many wide fire boxes are in use, with box over the wheels, and on engines of this type they are placing a heavy cross-bar on top of frame, and supporting the fire-box in the center at each side, where the expansion hangers at the back and front are alone used it was found that the frames sprung up under the box.

These big fire-boxes have crown bars over the center, and crow-feet and straight stays on the sides, many of the old boilers being changed by cutting off water leg at side seam, and putting the "Mother Hubbard" on there.

There are a great many engines with long fire-box on top of frame, but between the wheels, and many deep fire-boxes have been changed to this form. Mr. Graham, superintendent of M. P., finds in this change 18 per cent. increase of grate area.

In all new engines they are using straight steam pipes in the front end, and the walls of the live steam passages in the saddle are separated from the walls of the exhaust passage by an air space. This change cannot help but save some heat now wasted. Most of the big fire-box engines have the dome in the center of cab, and all the gauges, etc., are faced toward the engineer. Consolidation side rods have but one knuckle joint, the front one, the back section of rod is independent; this requires longer pins on two back pair of drivers, but the rods are found to wear longer, and give less trouble.

Consolidations have all drivers flanged, and they do not cut flanges as bad as some engines we have seen where half the tires were bald; the secret of this success is no doubt found in the fact that plenty of lateral play is allowed in the forward and back pair, and a very short radius bar for pony truck is used.

One neat little kink on road engines is their iron pilot plows, these plows are nearly as high as the pilot, but are made in two pieces each side, the lower piece hinged strongly to the top and folded up against it when road is clear of snow; this prevents, in a great measure, the raising of dust and dirt that is thrown upon the working parts by the movement of the air-tight plow through the air.

In the shop there is a very good cylinder boring-bar of their own make that is run by power—it is very much like the bar made by Pedrick & Ayer.

False seats have lugs on the lower side, that fit into the ports and prevent displacement of the false seat.

Snap rings are used on pistons, and, in some cases, are given a new lease of life by springing into them a ring of spring steel wire.

For lining up guides, etc., by the cylinder, the old split-hair line is discarded. They use a long bar of about 2½ inches diameter, and as long as any cylinder and guide combined, this bar fits a gland with a taper outside plug, this gland, when forced into the stuffing-box, centers the back end of the bar, and on the front end a spider is used with a taper fit for the counterbore of the cylinder. The same bar will answer for all sizes of cylinder by providing different sized heads and glands for it. This rig is strong, not liable to be sprung out of true or to derangement when once placed in a cylinder—a great fault with the line—a helper can adjust it. The fit for the bar, both in the head and gland, are long, so as to insure the taper of both pieces entering their seats fair.

This shop does all the work for the steamers, ferries, docks and coal mines of the company, and the shops are full of more or less of this work all the time.

There are two large roundhouses here, and on the occasion of our visit they were full of engines, and there were as many more in the yard. The open winter has been a dull one for coal-handling roads, and, while it has saved thousands of dollars, and much suffering to the poor, has put many of the boys on half time.

H. J. Small, Superintendent of M. P. of the Southern Pacific, says of the crews on the snow-plow trains: "The pusher engine crews remaining with their engines during the entire siege, getting what sleep they could on their engines during delays, many of their meals being prepared by themselves, using the fire-box as a range and the coal scoop for a frying pan. They thus kept themselves in readiness to obey signals at any time, day or night. It was an exhibition of endurance and fidelity to duty that is seldom witnessed." Let the S. P. officials make a note of this, and remember it when the men send to headquarters and ask some slight favor, or that a wrong be made right.

The Chesapeake & Ohio road proposes to establish a line of ocean steamers from Newport News, Va., to Liverpool, *via* New York.

The Beginning of the End.

The *N. Y. World* of February 25th has the following information:

"The telegraph operators on the Long Island Railroad have been informed that they must leave the Order of Railway Telegraphers or lose their places. This is the decree of Czar Corbin."

This order is the youngest and weakest of all the railroad organizations, and is, therefore, the one to be attacked. Such action by Corbin and other men like him are doing a great deal for organized labor, although they do not know it; there is but one defense for a weak order like this, and that is federation with all other orders, and Mr. Corbin is doing more than any labor leader to accomplish the complete amalgamation of all. We were not for federation at first, but can see only good in it now, and are therefore for it. It is all that is left except abject submission.

The Pennsylvania Railroad Company is erecting on the site of the old Mount Pleasant Park, in Jersey City, one of the largest roundhouses in the world. It will be 323 feet in diameter, and will accommodate forty-five engines. The roundhouse is to be in the centre of the new railroad yards, in which there are to be five miles of tracks.—*Ex.*

The Swinerton locomotive "Onward" is running on the C. Ry. of N. J. The elevated locomotive that is being equipped with pologonal tires has not yet been tested, but probably will some time during the month.

A great railroad man once said that if he could save what coal he could hold in his hand for each mile made, he would pay all the dividend the stockholders could wish.

The *R. R. Trainmen's Journal* has greatly improved of late, although it has long been the leading journal in its particular field. It is alive.

Illinois leads all her sister States in railroad mileage, having 10,079 miles, Rhode Island has the least—214

President Blackstone, of the Chicago & Alton, in his annual report of the road's business, under the head of "Remarks," gives it as his candid opinion that the only correct and proper solution of the railroad business of this country is for the government to assume control of and operate the railroads, just as it does the postal business. Mr. Blackstone gives at length his ideas of how this can be done, how the employes in all departments can be well selected, and politics kept out of the service just as it is kept out of the army. His idea is that when the government takes a road all employes should be considered as on probation for the first year, if they give good service for that time their jobs be then secured, and removal possible only for cause after trial, "during good behavior" being their time of service. It is remarkable to hear such a proposition from a successful railroad president, and still more remarkable to know that the sentiment is backed by the board of directors. Mr Blackstone thinks that adverse legislation and the legislative fixing of rates will eventually force something of this kind upon the country.

We have received from the inventor, H. C. Cunningham, Topeka, Kan., one of the train order files, illustrated in our issue of January. It is one of those simple little things that save time, worry and mistakes, and is well worth having

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L. B. Eaton, one of the best known supply men in the country, who for a long time handled the Gardner governor, has taken a position with the Martin Anti-Fire Car Heater Co., of Dunkirk, N. Y.

The great Forth bridge in Scotland will be formally opened March 4th. It is the largest bridge in the world—is 8,929 feet long; there are two spans of 1,700 feet each. The span of the Brooklyn bridge is 1,595 feet.

It is estimated that there are 12,100,000 horse power in steam engines in the United States—this includes locomotives and steamers

THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III. NO. 4. NEW YORK, APRIL, 1890. $1.00 per Year or 10c. a copy.

Assorted Stock.

"Now don't go and print this," said the old-timer, familiarly throwing his leg over the corner of our desk, "and I'll tell you a good little story. 'Twas a right smart while ago that I was firin' for old Hank Betters, when one night, jest as we was ready to pull out, a saw-mill-looking chap came up and struck Hank fur a ride."

"Ever carry ingineers?" said he.

"Well, yes," said Hank, "when we can get the real article put up in their own juice."

"I'm a ingineer, and I wan'ter get over the road."

"What road ye offon?" said Hank, wipin' his hands on a bunch of waste.

"Empire Line," said he, namin' a fast freight line, that don't own a single ingine.

Hank knowed in a minit that that feller was no railroader, and like as not would take to the brush if the pop went off; but he reached right out for the feller's hand, give it a hearty shake and says:

"Why, yes, I remember you now, uster run over there myself; couldn't place you for a minit; yes, yes, you uster run one of them ingins with *one* driver and *two* startin' bars, had ter key 'em up with a shovel—Barrow ingins—I remember 'em. You was a good runner on a grade, but they are awful particular here and we can't carry ye; good-night."

Parliamentary investigation into the running of trains on railroads entering London from the south, shows that, upon an average, only about 60 per cent. of passenger trains enter the city on time.

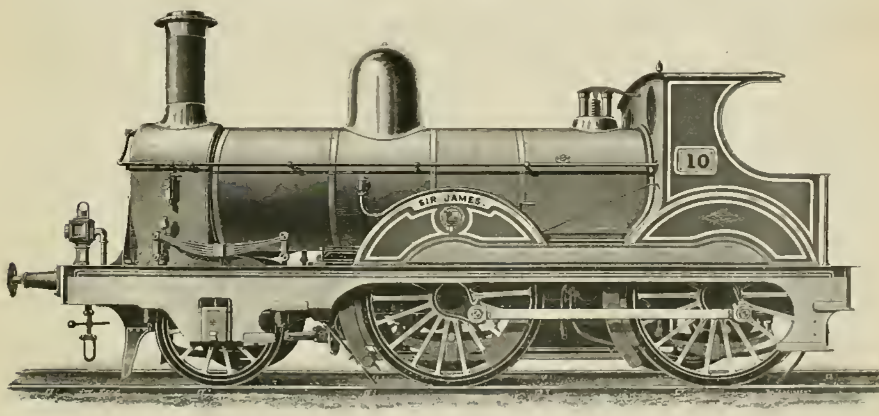
An Irish Locomotive.

The accompanying picture, for which we are indebted to *The Engineer*, London, Eng., represents the very latest design of engine used on the Irish express trains.

The engine was built by Dubs & Co., Glasgow, from the designs of Mr. John G. Robinson, Locomotive Superintendent of the Waterford & Limerick Railway. The engine is of the Irish gauge, 5 feet 3 inches.

The leading springs are of a pattern not used in this country, and were, we believe, designed by Mr. Gooch, of the Great Western road.

The engine we illustrate is named after the present chairman of the line, Sir James Spaight, J. P. The following are the principal dimensions:



An Irish Locomotive.

Diameter of cylinder	17 in.
Stroke of piston	24 in.
Diameter of wheels, coupled	6 ft.
Diameter of leading wheels	4 ft.
Working pressure	150 lb. per sq. in
Heating surface in tubes, brass	1,000 square feet.
" " fire-box	110 " "
Total heating surface	1,110 " "
Area of grate	18 " "

The total weight of the engine, in working order, is 81,676 pounds, of which 55,328 pounds are on the drivers.

The automatic vacuum brake is fitted to the coupled wheels and tender wheels. The leading axle is fitted with traversing axle-boxes, with inside and outside bearings.

The tender holds 2,000 gallons of water, and 3½ tons of coal. It is carried on six wheels, and weighs fully 50,300 pounds. The total wheel base of engine and tender is 35 ft. 2 in. The engine has given entire satisfaction, and reflects great credit on the builders for workmanship and finish.

Comparing this locomotive with American 8-wheelers, with which our readers are all familiar, will show them the essential difference in practice between the two countries.

The cab is the most noticeable difference, except that this engine is inside connected. The total absence of equalizers would make this a very hard engine to ride on our uneven roads, and the coupling arrangements, with provisions for taking up the slack, seem light, trappy and slow.

The Ramsbottom safety valve, so common in Europe, is never seen here; in this arrangement two valves are held to their seats by one spring.

In one of the little strips of green park in the streets of Macon, Ga., there is a monument to the memory of Wm. M. Wadley, who died in '85, president of the Central Railroad of Georgia. This monument was raised by the employes of the road of which he was the head, "To the memory of a good man, who came up from the ranks."

On March 10th, a special train on the Pennsylvania made the trip between Washington and New York in 4 hours and 17 minutes, beating the record 55 minutes.

The Master Car Builders will meet at Old Point Comfort, Va., in June.

Out of Town.

John Rice, of Freeport, Ill., sends us this clipping from *Owen's Work*, and asks us what we think of it:

"Bagging or bulging of boiler-plates over the fire is in nearly every case traced to the use of oil in the boiler. Oil is inadvertently fed to the boilers by the false economy of turning the exhaust steam into the water tank, where the oil is caught and pumped into the boiler. Oil gathers the scum and dirt into a cake, which settles in a crust on the crown sheet, keeping the water away from the iron, which becomes heated, and the pressure causes it to bulge down."

We think the mechanical editor of the above paper is away at present. One door does not make a building.

Manly Action.

Under the new schedule of wages that is to go into effect March 1 on the Rock Island, freight engineers, who have been receiving \$4.15 per 100 miles, will hereafter receive \$4. On the Chicago, Kansas & Nebraska branch of the road, the engineers who have been receiving \$3.85 will hereafter receive \$4. The heretofore existing four grades of engineers will be reduced to three. Passenger engineers on all trains will receive 3½ cents per mile, and switching engineers \$2.70 a day.

It is easy enough to say, "The men on the other end of the road are not getting standard pay, and must have it"; but when a body of men say, "The boys across the river are getting less than full pay, we are getting a little more, cut us down to standard, and raise theirs up to it," it shows more of a brotherly spirit than usually exists.

We should have been glad to see all the men on the road get \$4.15, but there was no hope of that, and the way things were evened up speaks volumes for the spirit of fairness in the rank and file. Besides that, they got rid of one grade of pay. This road had four grades—one is enough.

Relief Cock for Air-Brake Reservoir.

Harvey S. Park, of Chicago, has just sold to the Westinghouse Co. a neat little invention of his, in the shape of a relief cock for auxiliary drums on automatic brake cars.

All railroad men know the result when the pressure in the train pipe and engine drum is not sufficient to release the brakes and re-charge the drums—either the air in the drum must be reduced, "bled," or that in the train pipe increased above the pressure at which the refractory brakes are set. With a long train this is a slow process, and the usual plan is to open small cocks on the drums provided for that purpose; this is wasteful of air, takes time, and there is always danger of the cocks not being closed properly.

With Mr. Park's invention, all that is necessary is for the trainman to pull the valve open—it closes itself automatically.

The valve is screwed into the reservoir, and a wire or cord attached to the levers, as shown, is run to each side of the car, to facilitate handling.

In the body of the plug there is a stem E with a piston B; on the lower end of this stem there is a valve F, on a seat a, and held there by the pressure, and also by a spring l. When it is found necessary to "bleed" a car, the cord or wire is pulled and the end of one of the levers h pushes the stem down and opens the valve F, the air follows the passage b and enters the chamber P above the piston, forcing and holding it down, and escapes through the port d and the passage c.

As soon as the pressure is reduced below the pressure required to compress the spring, the latter will force up the stem and close the valve.

Thus it will be seen that a relief valve is obtained, the normal condition of which is closed, but which can be opened instantly, and will of itself close, requiring no attention other than opening it.

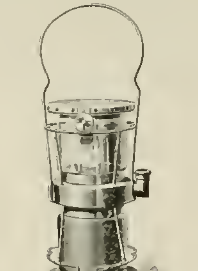
There is no doubt that this little device will save time and worry, and be another safeguard in the automatic brake equipment.

A Double Lantern for Railroads.

On this page will be found an engraving of the Metzler reversible lantern, made by the Metzler Lantern Company, of Philadelphia, Pa.

This lantern has been on the market for two or three years, and has been improved and developed up to its present standard. It is about the height of an ordinary lantern, but the globes are slightly shorter, and the cap and base, which are alike, are broad and flat. The oil tank is in the center of the lamp, with the filling cap outside, as shown on the right of the cut; this admits of filling without opening the lamp in any way.

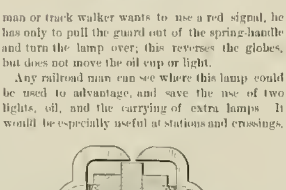
Two globes are fitted as shown, and, of course, can be of any colors, preferably white and red, the upper globe surrounds the light, the lower one is darkened by the oil cup. If a trainman, station



RAILROAD SIGNAL LANTERN.

man or track walker wants to use a red signal, he has only to pull the guard out of the spring-handle and turn the lamp over; this reverses the globes, but does not move the oil cup or light.

Any railroad man can see where this lamp could be used to advantage, and save the use of two lights, oil, and the carrying of extra lamps. It would be especially useful at stations and crossings.



RELIEF VALVE FOR AIR-BRAKES.

The Best Agreement in America Between a Railroad and Its Engineers.

The following agreement between the management of the Central Railroad & Banking Co., of Georgia, and the engineers of the line, is the best one for the men we have ever seen, granting at once more privileges, more rest, and greater pay for the work done. Further reference to this case will be found in our editorial columns.

1st. The pay of enginemen on all divisions except the South Carolina shall be as follows: Enginemen, \$4 per day for every day they are on duty, Sundays included. Enginemen on work trains, \$3.25 per day for every day they are on duty, Sundays included. Enginemen on switch engines shall receive \$3 per day for every day they are on duty, Sundays included. Twelve hours to constitute a day's work, one hour for meals. Enginemen on branch roads, where their run is 60 miles or less, shall receive \$3 for every day they are on duty, Sundays included. When their run is over 60 to 100 miles, \$3.75 per day for every day they are on duty, Sundays included. Where their run is over 100 miles, they shall receive \$4 per day for every day they are on duty, Sundays included.

For the South Carolina Division the pay of enginemen shall be as follows: Road service, \$3.75 per day for every day they are on duty, Sundays included. Work trains, \$3 per day for every day they are on duty, Sundays included. Switch engines, \$2.50 per day for every day they are on duty, Sundays included. Branch roads, \$3.75 per day for every day they are on duty, Sundays included. The three enginemen now receiving \$4 per day shall remain so, for every day they are on duty, Sundays included. Enginemen shall be construed to be on duty so long as they are subject to be called on, and respond to service, that is, until they are suspended, discharged, or leave of their own accord, on leave of absence, or do not respond.

Where men are not now receiving the rates of pay herein mentioned, it is agreed that they will be advanced thereto from date of this agreement.

2d. When, in the judgment of the company, a diminution of force is necessary, the men promoted within the last twelve months from date of this agreement shall be reduced in order of seniority, to trains and engines of lower grade, and to firing. If further diminution is necessary, the engineers promoted prior to the time herein mentioned will then be suspended in order of seniority, and for pro rata time.

3d. Enginemen of freight and passenger trains shall not be required to run more than one consecutive round trip at night (embracing two nights), nor two consecutive nights on first division of main stem, and Macon to Montgomery, and Columbus to Birmingham, except in cases of emergency. Should this emergency arise, he shall be paid an extra day. All runs shall be so arranged as to afford a proper amount of rest to each man. All delays of more than two hours over schedule time shall be paid twenty-five cents per hour, first hour included.

4th. Enginemen on all freight trains shall run, first in, first out, from all terminal or relay points.

5th. Hostlers shall be provided at Savannah, Macon, Atlanta, Columbus, Birmingham, Montgomery, Albany, Augusta and Port Royal; but nothing in this article shall be construed to prevent the master mechanic from requiring the men to report at the roundhouse for the purpose of giving their engines proper attention, and after they give their engines proper inspection and attention they shall not be required to stay at the shops any longer.

6th. Enginemen of trains leaving Savannah, Macon, Atlanta, Columbus, Augusta, Montgomery, Birmingham, Albany, and all other terminal and relay points, shall be called between the hours of 9 o'clock P. M. and 6 A. M., one hour before leaving time. The caller shall have a book, which the party shall sign at the time he is called, for a radius of one mile, as long as one can perform the service at each place.

7th. An engineman who may be suspended will be given a hearing within five days from the time his report is rendered, with the understanding that the company shall take as much more time for the investigation as they may deem necessary, at their own expense. In the event the decision of the division officers be deemed, by the party on trial, not to be in accordance with the evidence developed, or to be unduly harsh or severe, he shall have the right to appeal to the general manager, in the event he is not found at fault, he will be paid for lost time. The investigating committee shall consist of division superintendent, division master mechanic and a general grievance committee man.

8th. At all points where there are roundhouses and foremen, enginemen will not be required to clean out boilers, or pack engine or tender trucks; but this article shall not be construed to relieve them from taking reasonable care of their engines, and doing the usual work thereon.

9th. There will be a place provided in southwestern yard at Macon, where enginemen will put the engines of all freight trains when hostlers are not on hand to relieve them. Hostlers will be furnished with books in which engineers will be required to report work to be done on engines. Hostlers will register for engineer whom he relieves.

10th. When engineman is off sick, his time will begin from the time he reports for duty.

11th. Enginemen attending court or other business for the company, which takes them from their engines, will be paid full time and necessary expense.

12th. All matters not covered by this agreement shall be determined by the present practice of the company.

13th. There shall be an examining board, consisting of three engineers for each division, selected by division master mechanic, to examine all applicants for position or promotions.

14th. This agreement shall be and remain in force for the period of one year from date thereof, and shall not thereafter be changed by either party, except after ninety days' notice in writing to the other. Either party violating this agreement intentionally shall be dismissed from the service of the company.

Improved Form of Steam Pipes and Passages.

The accompanying illustrations show the modifications in steam pipes and saddle passages designed by Supt. of M. P., Chas. Graham, of the D., L. & W., and used on that road. This form of pipe and passage has also been adopted by the Dickson Locomotive Works.

Instead of the old-style of steam pipe, with a short **T** pipe, or "nigger-head," with the faces of ball joints on each end of pipe at right angles to each other, this pipe is perfectly straight. The **T** pipe extends out on the sides, to make the joints come directly over the passage in the cylinder, a double ball joint is used at the junction of the **T** and steam pipe proper, and the joint is held by a single large bolt going through the pipe and **T** with a ball joint under the head; no shearing or twisting strain can be brought on any of the bolts.

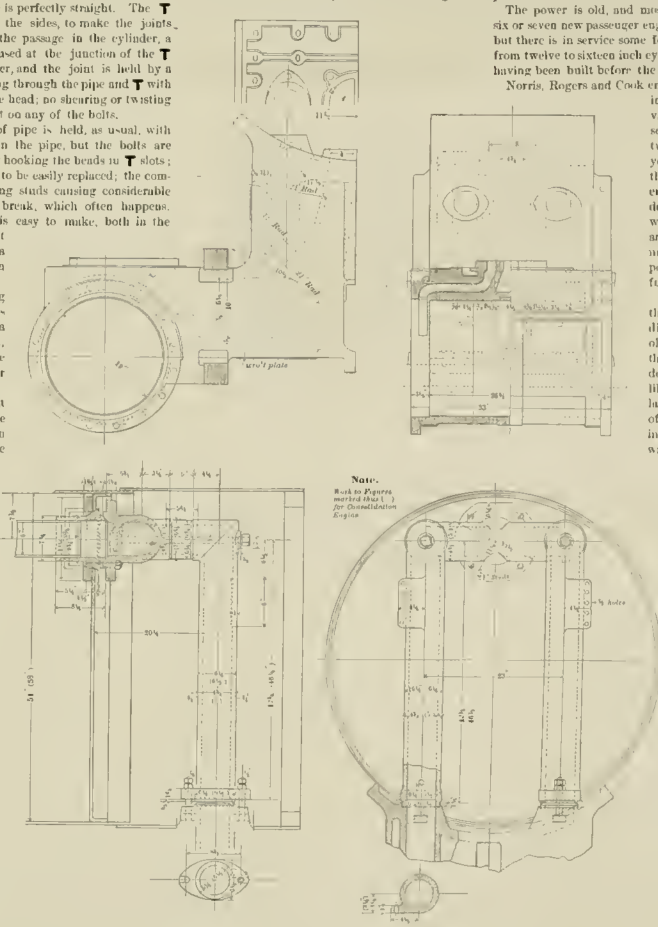
The bottom joint of pipe is held, as usual, with bolts through lugs in the pipe, but the bolts are held to the saddle by hooking the heads in **T** slots; this allows the bolts to be easily replaced; the common practice of using studs causing considerable trouble when they break, which often happens. This straight pipe is easy to make, both in the foundry and shop; it can be swung in a lathe or easily set on a drill press or mill.

By casting a long lug on each pipe, as shown, and drilling a number of holes in it, a substantial and true support is made for draught pipe.

The improvement in cylinder saddle passages consists in separating the live steam passages from the exhaust passage and the outside of the saddle casting by an air space; in no place does one wall of metal separate these two passages; on the side of the saddle there are two openings covered by circular wrought-iron plates, and another and larger one at the bottom of the saddle; these allow inspection, and are convenient in making the castings.

Where live steam, at least 100° hotter than the exhaust, is carried for a long distance only separated from it by a half-inch wall of cast-iron, a splendid conductor, a great deal of heat must be abstracted by the cooler body and lost. This form of saddle costs very little more than the old style, and must result in a saving of heat—just the same as covering a steam pipe does.

To save making separate drawings for different classes of engines on this road, two sets of figures are used, those enclosed in brackets ( ) being used only for consolidations.



Improved Steam Pipes and Passages.

S. A. Alexander, of York, Pa., has a new edition of his well-known Ready Reference for Enginemen, out for 1890. It goes without saying that it is better than those that have preceded it—and there were no winged insects on them.

A Railroad With a History.

During a recent visit to the South the writer had the pleasure of riding over the line and visiting the shops of the Western & Atlantic Railroad.

This little road runs from Chattanooga, Tenn., to Atlanta, Ga., a distance of 138 miles; it has 44 miles of sidings and branches, making in all 182 miles, it is standard gauge, laid with 56 pounds steel rails.

This road was built by the State of Georgia in 1850, it was valued at $8,000,000 in 1870, when it was leased for twenty years to the present company, who give bonds for the full value and pay $25,000 a month into the State treasury as rent.

There are some sixty locomotives in use and about 1,200 cars.

During the war this road was one of the principal arteries of supplies to the Confederacy, and many of its stations are historic, as the stage on which many a hard fought battle was won and lost.

With its northern terminus at the foot of Lookout Mountain it follows the winding Chickamauga, whose waters have been red with human blood, and runs almost directly south to Atlanta, Ga., passing through, on the way, Big Shanty, Kenesaw Mountain, Marietta, Smyrna and other battlefields.

The road is pretty well built, and a good deal of it stone ballasted, but the heavy rains at the time of our visit had softened up the bed so much as to show many low joints. It is easy to see that the road is no old one; large trees are growing in the pits dug to make the embankments.

The shops are at Atlanta, and are under the charge of Master Mechanic M. L. Collier, the shops are old and small, being little buildings built against the outside of a roundhouse that is a complete circle.

The power is old, and mostly small, they have six or seven new passenger engines that are modern, but there is in service some forty locomotives with from twelve to sixteen inch cylinders, many of them having been built before the war.

Norris, Rogers and Cook engines, that have been in battle, are here. A visit to the roundhouse seems like going back twenty-five or thirty years for a like visit, there are the little old engines with a preponderance of brass, many with the steam chest and cylinder heads left uncovered, and the iron polished, and all gracefully showing their age.

In the roundhouse there are a half dozen dismantled and rusted old hulks of this sort that have been long dead, and now seem like honored remains laying in state. In one of the stalls, undergoing extensive repairs, was the "General," the engine stolen from the Confederate camp at Big Shanty, in 1862, by a number of daring Federal scouts, and run north in an attempt to destroy the bridges on the line, and cut off the supplies of the Confederate army at Chattanooga.

One cannot look at this old engine and not feel a thrill for the brave men who fought and died over her in the great national struggle. The reason that these old engines are still in service is undoubtedly caused by the fact that the lease is about to expire, and the officials of the State are unwilling to allow the lessees anything for betterment of the equipment.

They have one kink here that looks worth copying; they use but one cylinder cock to a side, and that is located in the center of a pipe from each end of the cylinder; this cock can be made of good size, reduces the number of valves to keep ground in, and does away with considerable light rigging.

The turntable here was too short for the new engines, and Mr. Collier lengthened it in a novel way. Close to the outside of the rails, about six feet from one end, he pivoted heavy iron bars, perhaps three or three and a half inches square, at the point near the rails these bars were drawn to a thin wedge, and the other end was left full size and slightly bent up; there was heavy support put under them at the end of the table, but they were left free to be moved sideways, and on the pivot at the small end; when an engine is to be turned, whose wheel base is longer than the table, the outer ends of these heavy hooks are placed on the rail, and a pin holds them there, then the tender truck is backed upon the inclined extension, and the engine is turned with one pair of wheels elevated above the tracks converging at the turntable.

All the engines are named; most of them are equipped with steam driving brakes, diamond stacks and short fronts are the rule, but the new engines have the extension and the open stack.

The road is a connecting link for several lines, and has a very heavy local trade, the earnings of the road amounting to about a million and a half of dollars annually.

It looked rather strange to see several sections of every freight train with one of those little engines ahead of each section, they are rated all the way from five to twelve cars. A consolidation of modern size could pull forty cars there easy; but in order to use such heavy power the bridges on the line will have to be renewed, and that will take some time.

It is a good road for engineers, as they get $4 per day whether they work or not, with a good rest at each end of the line.

A Peculiar Journal Brass

The journal bearing shown on this page has been patented by F. W. Johnstone, Supt. of M of the Mexican Central Ry.

Attempts to increase the bearing surface of journal bearings by extending the brass downward and enveloping more of the journal result unfavorably on account of the brass hugging the journal as the crown wears down, thus increasing the amount of pressure brought upon it without adding to the support of the load carried, and the result is a more rapid wearing away of journal and brass, and a tendency to heat. Mr. Johnstone overcomes this difficulty by making the brass in three parts, the center portion forming a crown bearing, and the two wings pivoting upon it in such a manner that the load which rests upon them is thrown upon the journal at right angles to its periphery, thus avoiding any tendency to wedging and hugging the journal, as each square inch of bearing surface supports an equal proportion of the load, and at the same time brings it to bear upon the journal in as favorable a position as that supported by the crown bearing or center piece.

It will be seen that all the load carried rests upon the two wings. If, then, we have 8,000 lbs. on a journal, the load is so distributed that 4,000 lbs. is carried by the crown or center piece, and 2,000 by each wing, which is in proportion to their areas of effective bearing surface.

In the ordinary M C. B. brass bearing 3¾x6¾, there are 22.78 square inches of effective bearing, while with this divided brass the bearing is 4½x6¾, equal to 30.87 square inches, or 33 per cent. more than the M. C. B.

This large increase of bearing decreases the pressure per square inch, and allows of more efficient lubrication. These brasses have been giving good results on the truck and tender journals of the Central Mexicano engines for the past four years, and the wear of the brasses has been found to average but one ounce loss in 1 976 miles.

Coroner Lindsay, of Brooklyn, held an inquest, last month, over the body of Daniel Ostrander, one of the employes of the Kings County Elevated Railroad. The deceased was cleaning the engine at the Eastern Parkway and Pennsylvania avenue, when he was struck by some projection, and had his skull fractured. A verdict in accordance with the facts was rendered. Cleaning outside while a locomotive is in motion is at once dangerous and careless. If firemen are required to keep their engines clean, they should be given an opportunity to clean while engines are standing still.

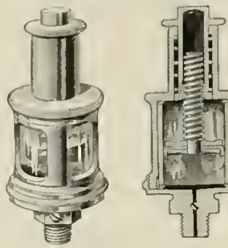
The C., B. & Q. have just ordered 6,750 sets of air-brake for freight service. The road will be entirely equipped at once.

An Improved Grease Cup.

For many purposes heavy grease is taking the place of thin oil, and its use has been a success on locomotive pins, guides and trucks on a number of roads.

The cup here shown has some conveniences not found in other cups of its kind, and is, withal, a very neat and attractive cup. It is filled by taking the cup off the base, and screwing the piston up, when the cup is filled the screw is relieved and the large spring shown around the top sleeve compresses the grease, forcing it out of the feed hole at the base.

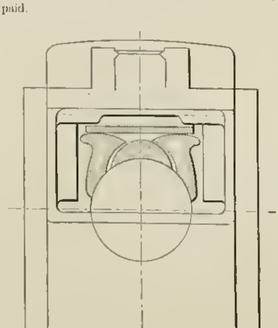
This feed is an important feature of the cup; it can be adjusted, opened or closed by simply turning the screw head shown in the shank of the cup, the body of the screw being a small plug valve as shown in the detail. Most grease cups require the relief of the pressure by screwing up the piston; this leaves the feed open.



Benners Grease Cup.

The cup is heavy, has no sharp projections, and the glass enables the engineer to see and regulate the feed It is being placed on the market by The Benners Lubricating Company, of Elizabeth, N. J.

Air-Brake Practice, by J. E. Phelan, is now ready for delivery. The book is gotten up in first-class shape, and will be sold at $1 25, postage paid.



Peculiar Journal Brass

M Nicolai, the engineer at the head of the commission that has been investigating the question of a Siberian railway for the Russian Government, has reported that the whole line can be completed by 1900, at an expense of about $130,000,000.

Don't always wait for a precedent—do things because you think them right, not because some one else has done them.

Send for club rates for Phelan's book on Air-Brake Practice.

The Lake Shore Accident.

On the evening of March 6th, a passenger train on the Lake Shore road broke in two, at a little place called Hamburg, near Buffalo, and the rear part crashed into the forward section, killing six people, and injuring seventeen.

The train consisted of ten cars, four baggage and express, two day coaches, four Wagner sleeping cars, and one dining car.

At Dunkirk the train parted in starting, the five Wagner cars breaking off, this was caused by a Cowell and Miller coupler coming together; in breaking apart, an air-hose was pulled off, and the brakes on both sections of the train were set.

The cars were coupled with link and pin, and a car repairer got a hose to put on in the place of the ruptured one; but the conductor—as he testified himself, before the coroner—told the repairer to let it go, as they had brakes enough to hold them, and went ahead after bleeding off the brakes in the rear cars, and closing the cock in rear end of pipe on the last day coach.

The train ran some 30 miles in this condition, and again parted. The train passed one station, where the people on the platform noticed that the] cars were some three feet apart, and it is thought that it ran some two and a half miles in this condition. One of the passengers testified that the bell rope was not stretched hard enough to break it, until a few minutes before the crash.

The conductor was on the forward section of the train, and when he found that it had parted, signaled the engineer to stop.

The engineer testified that the brakes were applied from the train, and the stop made without his help.

Be that as it may, the rear cars crashed into the forward part of the train, telescoping the day coach, with the fatalities recorded above.

The conductor was a man of 30 years' experience, and he testified against himself in a manly way, taking upon his own shoulders the whole weight of blame. He swore that he prevented the replacing of the hose, to save time, that, had it been replaced the accident could not have happened, that he could have prevented the accident by switching the car with defective coupler behind, or by setting it out, that the accident could have been prevented had he manned the hand-brakes of the rear part of train, and notified the men to look out for a breakaway. None of these things were done, and the conductor honorably takes to himself the blame, and says his anxiety to make time caused the death of the people in the coach.

As soon as the conductor stopped the forward part of the train he jumped to the ground, saw the rear end coming at high speed, and, realizing what he had done, wildly signaled with his lantern to the engineer to go ahead. This the engineer tried to do, but could not, because he could not release the brake.

The conductor says he does not remember of having opened the conductor's valve in the cars, and does not think he did.

It is plainly evident that the conductor, suddenly realizing the blunder he had made, lost his head; he was a man of too much experience to have stopped the forward end of the train with his wits about him.

Most of the papers in the country blame him, and justly, for gross carelessness, one or two blame the management, averring that they insist on fast time, and will brook no delay—there may be something in this—but it remains for the *Engineering News*, of this city, to blame the engineer equally with the conductor.

We quote from its columns:

"If a train in this condition was to be run at all, one would have thought that all the train crew would at least have been on the alert, since they must all have known of its condition, in a general way at least, and a second breakaway was the most natural thing in the world to expect. Had they been so alert, it should have been easy to stop the rear part before collision, or at least greatly diminish its force, by hand-brakes, for too much has been made of the down grade on which the breakaway occurred It is only 16 ft. per mile, and 3¼ miles long, falling 52 ft. in all. Not a single man of the crew was, in fact, on the alert. The breakaway was not discovered for some time after it occurred, and when it was discovered, the conductor did at once what it is drilled into every railroad man from his youth up must not be done under any circumstances in such a case. He gave the signal to stop, two taps of the bell, thus showing that he had been giving no serious thought to the condition of his train, for it is inconceivable that he was not aware of the danger of such a stop, before it was certain that the rear part was stopped. Much has been made of this incident, as if he were alone to blame; and his conduct was certainly the extreme of negligence. But this alone would not have caused the accident. The engineman was almost equally to blame He admits having previously received from the bell cord, when it parted, the significant *one tap* signal, which is recorded in all train rules as meaning, 'train parted,' and then the Lake Shore rules, as well as common sense and general practice, require that 'the forward part must not stop until *the engineer* is sure that the rear part of the train has stopped.' To this signal however, as also to a succeeding one, he says he 'paid no attention.' He claims that he had nothing to do with stopping the train, but that brakes were applied from the train, and he 'could not release them,' but his testimony on this point seems most doubtful, and he *could have released them, even if so applied, had he been on the alert and made the effort in time.*"

The last sentence simply shows that the writer knows little of the principles of the automatic air-brake. The engineer could not release the brake in *any* length of time unless the conductor's valve in the cars was closed—if the brake was applied from there. The only way to release the brake, is to establish a pressure in the train pipe *greater* than that in the brake cylinders; and it is plain that this cannot be done when a valve is open, or there is any other opening from the train pipe to the atmosphere.

It is far from our purpose or our spirit to hold an engineer blameless, simply because he is an engineer; but it seems that this man was helpless, and the brakes—for the time being—beyond his control.

That our esteemed contemporary does not know what it is talking about, when it gets on the subject of air-brakes it is only necessary to quote it again. Speaking of the bad condition of the couplers on the rear part of the train, it says

"And with the air-brakes on them absolutely useless and dead. *For, although there was doubtless much air pressure still remaining in the auxiliary reservoirs under each car, the train pipe being entirely open to the atmosphere through the unrepaired brake, made it impossible to utilize this air for braking.* The brakes were only released after the first break, by bleeding each car separately."

The italics are ours.

All men who know enough about the air-brakes to publicly accuse other men of manslaughter for not handling it properly, ought to know that it was impossible to release those brakes, when set at Dunkirk by the first break, without restoring the pressure in the train pipe, or bleeding out *all* the air in the brake cylinders and auxiliary drums. So long as there was a pound of air in the auxiliary drums and the train pipe was open, the brakes would set. So there could have been no air there to "utilize for braking."

One thing is certain—had the automatic brake been kept intact and given a chance, no accident would have happened, as it was the brake on the forward part of the train helped make the accident more severe.

When the automatic brake was first put into use it was thought that the conductor's valve in each car was an additional safeguard, and a cord was run from it the entire length of the car, but it was soon found that passengers meddled with it, and accidents were caused, and after the Spuyten Duyval disaster, a few years ago, the cord was taken out of pretty much all the cars in the country, leaving only a connection outside the closet. The old conductors' valve closed against a rubber seat with a spring, and when the handle was released they would close themselves, but they leaked and required attention, and it was thought best to replace them with a common plug cock, that had to be opened and closed by hand; with this arrangement it is possible to set the brakes and prevent their release, by opening this cock, just as the engineer claims was done in this case.

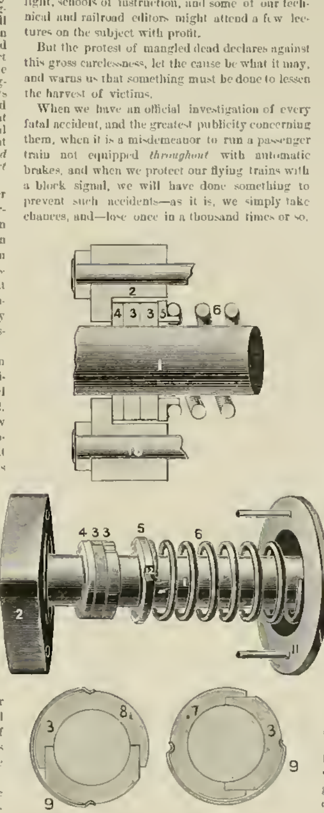
The writer has had some practical experience in the matter, and has long contended that these valves were a positive source of danger instead of safety, and we think their removal would be a good thing. It should be against the rules of any road, for trainmen to stop a train except in an emergency, and then a wire from each hose-head coupling to the end sill of the cars would make it an easy matter to disconnect the hose.

The engineers, as a rule, know more about the brake than other trainmen, and are therefore better able to handle it—there is many a trainman to-day that believes that air pressure holds the brake *off*, and that its reduction allows springs to set it.

What is wanted in this air-brake business, is more light, schools of instruction, and some of our technical and railroad editors might attend a few lectures on the subject with profit.

But the protest of mangled dead declares against this gross carelessness, let the cause be what it may, and warns us that something must be done to lessen the harvest of victims.

When we have an official investigation of every fatal accident, and the greatest publicity concerning them, when it is a misdemeanor to run a passenger train not equipped *throughout* with automatic brakes, and when we protect our flying trains with a block signal, we will have done something to prevent such accidents—as it is, we simply take chances, and—lose once in a thousand times or so.



The Partington Metallic Packing.

The accompanying illustrations show a metallic packing constructed on an entirely new principle, and of a different material from any other packing—the invention of a practical engineer of more than forty years' experience.

All other metallic packings have a common plan—the spring and steam forcing soft metal rings into a cone, thus closing them upon the rod.

All of these packings have one fault—they pinch the rod when steam is shut off and the engine is drifting, and in long runs down hill it often happens that the rings are hammered through the collar and come out as thin as tin.

In this packing no cone or small rings are used, and when steam is shut off there is no pressure on the rod, the rings are heavy, about three fourths of an inch square, and they are made of soft cast-iron.

The packing can be applied to any locomotive without altering in any way the stuffing-boxes.

The gland has a square recess in it, somewhat larger than the packing, and it fits steam-tight on the cylinder head Fitting the rod loosely is a heavy babbitt ring 4, that forms the joint between the gland and the first packing ring 3. There are two of these rings, made of charcoal iron, with a joint as shown in the detail drawing; the joints of the two rings do not coincide, and are kept from getting together by a pin in one ring loosely fitting a hole in the other, as shown. Behind these rings a brass ring fits flatly against the packing without touching the rod and supports the spring; this ring has openings on its outer surface that admit steam to the outside of the packing rings proper; the mission of the flat spring being merely to keep the pieces of ring in place.

The steam pressure closes the rings on the rod, and in drifting down hill this pressure is relieved and there is no tendency to crowd the rings into a cone.

We have been shown a set of these rings taken from a wrecked locomotive on the Canadian Pacific road, that have made over 50,000 miles, and the inside surface looks like a mirror.

This packing has been in use for some four years on the steamboats and on some of the locomotives of the C. P., and none of it has been worn out.

T. A. Summerskill, M M of the C. P at Portage La Prairie, Man., says he has it on a passenger locomotive that has made 80,000 miles without a leak or perceptible wear either of the rod or rings, and he estimates its life at 300,000 miles.

All the parts being larger and of stronger metal than other packing, there seems to be little reason to doubt its long life.

It is being introduced by Thomas Wallace, of 39 Nassau street, this city.

Byram Lodge, No. 271, Brotherhood of Locomotive Firemen, at Port Morris, N J, are building a hall and storehouse on the share plan—the lodge itself putting the surplus money in its treasury into shares, and individual members taking the remainder. The rents on storeroom, it is believed, will more than pay all interest, taxes, etc., and the lodge becomes a landlord, not only for its own hall, but for others beside. The plan appears to have been carefully worked up, and there seems little or no chance of failure. There may be the germ in this of a safe and profitable investment for lodge money, and the savings of individual members. If a little lodge like this, with less than 40 members, can see their way clear for a brick block, what could some of the city lodges of 200 or more men do in the matter, if they but put their minds to it?

Jenkins Bros., of this city, make more steam valves than any other concern in the country. The peculiar qualities of the metal they use for seats, which is not affected by heat or cut by wear, has given them an advantage over other makers. Why valves with Jenkins disks are insisted upon for steam heater work, and forgotten in locomotive work, we can't find out. The disk saves lots of grinding in. These valves have recently been reduced in price to a level with the common brass valve.

On the E. T., V & G. road, we saw in use seamless felt wicks for headlights These are so much better than Canton flannel wicks, are so much easier to put in and keep in shape, that engineers themselves would be glad to buy them if they but knew where to get them. They cost 25 cents a dozen, but we could not find out who made them.

The Savannah, Florida & Western burn more wood than coal, fat pine being very cheap along the line, less than two dollars per cord, while coal is dear. They have modern engines, but use the big balloon stack. It is one of the very few southern roads still employing colored firemen

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A number of letters have been received asking us to republish the whole or part of the Examination Questions by Mr Cushing. This we cannot do so soon, but back numbers containing the questions can be had either at this office or through any newsdealer.

We have a picture of an engine known as the "Mud Digger," on the B. & O., years ago. Who knows anything about her?

Relief Valve for Wheel Presses

In the wheel room of the Philadelphia, Wilmington & Baltimore Shops, at Wilmington, Del., they have in use a very efficient relief valve for hydraulic wheel presses, the invention of the foreman of this department, Jos. M. Meloney, who has recently secured a patent on the same.

Fig. 1 shows the device as applied to the press, within easy reach of the operator. Fig. 2 shows the valve in detail. It will be seen that the valve 1 is held against its seat by the spring and the pressure, and that its upper end, at 3, is packed with rings to prevent annoyance from water; there are three openings from the valve chamber to the pump's body, as shown. The cam lever comes against a stop at 4, and its movement is from the operator, and only a short movement is necessary; when this lever is at right angles to its present position, the valve is wide open, and the lever will stay in that position until moved by hand. The inventor describes the trouble with the old style of relief valves as follows:

"In mounting car-wheels upon their axles by means of a hydraulic press it is necessary that the movement of the ram be arrested at the moment when the wheel is forced to the proper point on its axle, since the action of the press, if continued an instant too long, will cause a displacement of the parts, which can only be remedied at the cost of much time and trouble. In this class of mechanism the pressure employed is so great, varying from one to five tons to the square inch, that much difficulty has been experienced in devising a relief valve capable of being unseated and opened instantaneously and at any required point in the progress of the work. Heretofore it has been customary to use a valve having a threaded stem operated by a heavy hand-wheel at the end of the press. As this valve is seated against the pressure, a considerable effort is required to unseat it when it is once fairly closed, and the size of the hand wheel, together with the low pitch of the screw, renders it almost impossible to open the valve and relieve the pressure at the exact instant necessary. The result is that the operator finds it necessary to unseat the valve before the completion of the work and then await the moment for opening it and arresting the movement of the ram. This not only delays the work of the press, but causes a rapid deterioration of the valve seat, which is soon practically destroyed. Other devices have also been employed to effect the same result; but, owing to the peculiar construction adopted, the valve can only be unseated by the stroke of the pump, and the accuracy of the work is thereby liable to be seriously impaired.

"It is the purpose of my invention to provide a simple and easily operated relief valve for presses of this class, which shall be capable of unseating and opening instantaneously by a single movement of the hand of the operator, and whereby the operation of the press may be instantly arrested at any moment, the construction of the parts being such as to permit their arrangement upon the pumping mechanism within easy reach of the operator as he stands where he can see his work."

We understand that several wheel press makers are about to apply this invention to their machines.

Men running wheel presses will appreciate the convenience of this device.

In the repair yards of the Central Railway of Georgia, at Macon, we noticed some iron cars with the tubular frame, built by the Iron Car Co. of Harrisburg, Pa., that had been in a wreck, the ends of the box part were entirely knocked off, the drawheads broken, but the frame and end sill of the car were intact, proving that they are far above the average car in strength. These cars were equipped with the Thermond M. C. B. drawhead (Janney type), and the absence of slack no doubt contributed largely to the safety of the stock in a shock like a collision.

The *Frog*, of Denver, having spun a cocoon of wit and wisdom about itself, has just broke out into an illustrated railroad paper known as the *Western Railway*. It is just as much nicer than the *Frog* as a butterfly is nicer than a caterpillar—and there were few 'skeeters on the *Frog*. The new sheet is "incorporated," like the Western towns, and Cy Warman is Mayor, Police Justice and Town Pump, with Dicer Swift as poet "Lariat."

Egbert P. Watson, Jr., junior partner in the firm of E. P. Watson & Son, publishers of the *Engineer*, died of Bright's disease on Feb. 24th. Mr Watson was but 27 years of age, and just entering upon a useful career.

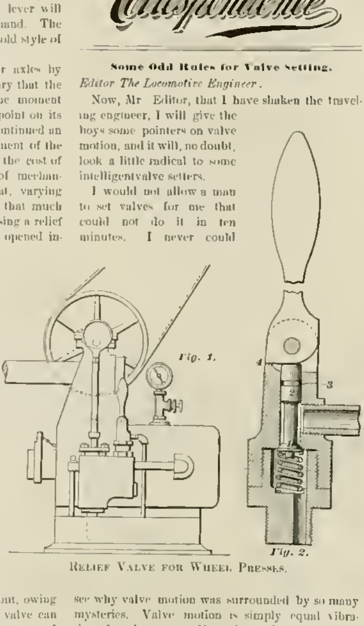
Correspondence

Some Odd Rules for Valve Setting.

Editor The Locomotive Engineer:

Now, Mr. Editor, that I have shaken the traveling engineer, I will give the boys some pointers on valve motion, and it will, no doubt, look a little radical to some intelligent valve setters.

I would not allow a man to set valves for me that could not do it in ten minutes. I never could see why valve motion was surrounded by so many mysteries. Valve motion is simply equal vibration of rocker arm. Now, boys, I will tell you how to catch on.



RELIEF VALVE FOR WHEEL PRESSES.

Take the center on one side and use that. Leave the other side on quarter, you need not use any tram, only the one you use to catch on center; by this means you use centers on one side and travel on the other. If you have uneven track, take centers from your main rod as it travels up and down.

Always gauge your valves with thickness of iron or tin that you want for lead.

Now for another pointer on it; if you are running a new engine, and her valves are square, you can keep her square as long as she stays out, by simply pulling down her shoes, and putting in a liner, which may amount to a piece of thin Russia or No. 8 iron. Setting up wedges causes your axle to be pushed ahead, which adds lead to the forward end of valve, and adds lap to the back end. In this way it is under control of engineer; your eccentrics and blades need never be touched, as your eccentrics generally come from the building shop keyed on. Blades generally come with two holes reamed out and fitted with bolts and with one oblong hole, so rods are set just right.

Now, boys, can any of you tell me how to gauge a valve without taking off steam chest cover, providing you know what outside lap she has? It can be done; and if you give it up, I will tell you in the next issue of THE LOCOMOTIVE ENGINEER.

Any locomotive, no matter how old she is, or how much lost motion she has, her valves can be set square, and she can do the same work she did in her first days, pull just as many cars, and run as fast, and when you take her in you will surprise the engineer and superintendent, unless her tires are worn bad, or boiler and flues are in bad shape. She will need little work. When valves are properly set, lost motion has nothing to do with engine working well. Of course your packing and cylinders must be good, and valves and valve seats good, so that there will be no blow in valves and cylinders, a tram should be called a valve gauge.

E. A. CAMPBELL,
Houston, Tex. Supt. M. P. & Mach'y

[Valve motion men will be after Mr. Campbell now—look out for them.]

Hopeful of the Future.

Editor The Locomotive Engineer:

Lately we read a good deal in the daily papers of the abuses to which enlisted men in the army are subject to from their officers, and the rank injustice with which the ordinary private is treated by court-martial. The court composed of the very men who heap indignities upon the private is not a tribunal to which he can look for either justice or mercy. There are other officials besides those connected with the army. Let us consider our railway officials, more particularly division superintendents, and superintendents of motive power. That they are not all angels nobody will dispute. As a general thing, in their intercourse with the ordinary private, or employe, they imagine themselves more of an autocrat than the Czar of all the Russias; to this rule, of course, there are many honorable exceptions.

The great army of railway employes (we refer to train and enginemen in particular) is composed of a finer body of men, physically, than the army of any of the monarchs of the old world, and mentally are equal, if not superior, to any other body of wage earners in this or any other country. Over this great army the superintendent holds full sway. He issues his orders and expects them to be obeyed to the letter. All very good, as long as the order has common sense for a foundation—something I am afraid many of them are lacking in. It is very necessary to have good discipline, but sometimes discipline is made a scapegoat of, to cover up great wrongs. The job of the average train hand or engineman is like "the sword of Damocles," suspended by a hair, and the hair is liable to be severed at any moment. That there are tyrannical, overbearing and autocratic officials in the railway service of the country is only too true. Many a happy little home has been broken up, many a man sent out a wanderer on the world's highway, simply because from some little infraction of duty he is cast adrift as a warning to others. I do not uphold anybody in shirking their duty; if there are any such, they should suffer the consequences; but I have seen many a man discharged for trying to do what he thought was right, but unfortunately for him his superintendent did not agree with him. When any mishap occurs, how very soon we are censured, but for duty well and faithfully performed we are never commended. Yet a kind word will do more good than a blow any time. Were the officials of many of our "great systems" a little more lenient, a little more in sympathy with those who are under them, it would be much better for those who are financially interested. Give a man to understand you are his enemy, he is not going to put himself out much to do you a favor; and it looks as if many railway officials consider every workingman his enemy, and treat them accordingly. Were he to act on the principle of friendship, and make them believe he was their friend, how much pleasanter, how much better it would be for all concerned. If some great corporations we know of were to adopt a friendly policy toward their employes, probably they would not have so much need of reorganizing their finances as they have at present. "Mighty oaks from little acorns grow," and "A small leak oftentimes sinks a big ship," are true maxims.

However, there is a lining of silver to the dark cloud that hangs over the position of the railway employe. The schoolmaster has been abroad in the land, and the good effects of his labor are becoming more apparent. Men are beginning to realize what has always been accepted as a fact, viz.: in union is strength. A confederation of the different classes of railway employes is coming. Just as sure as day follows night, united they will be invincible. Then the days of the tyrants shall pass away, no one-man power will go when the good time comes; then everybody shall have his just deserts, and no more than he is entitled to. In the coming of that good time, homes now desolate will be made bright, the face from which a smile has long since departed will light up anew, those whose hopes were crushed by tyrannical rules will take courage afresh, and have cause to bless the day when petty animosities and jealousies were forgotten, and the immortal words of Robert Burns will be exemplified:

> "When man to man the world o'er
> Shall brothers be, and a' that."

G. LEWIS.
Ft. Madison, Ia.

The "Neversink."

Editor The Locomotive Engineer:

Mr. Rauch probably remembers that the "Neversink" exploded its boiler during a heavy thunderstorm, and it was supposed that the engine was struck by lightning, as a flash and the explosion were simultaneous. One man's head was found across the Schuylkill river, and human limbs and entrails were seen hanging in the neighboring trees, and the almost perfect image of a man was imbedded in the smoke-stack.

S. A. ALEXANDER.
York, Pa.

The Shape of Signal Flags.

Editor The Locomotive Engineer:

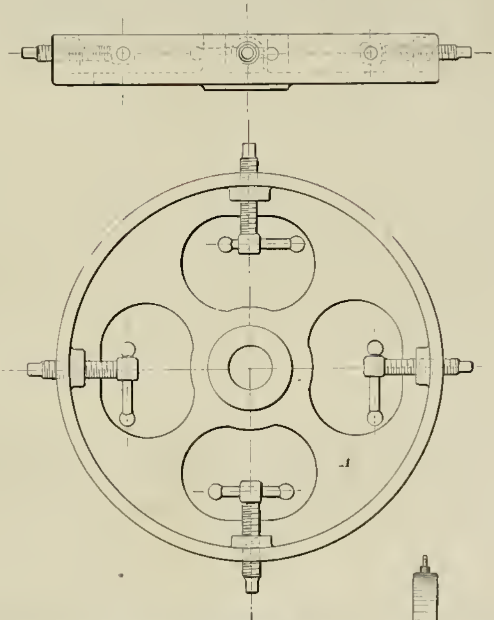
I am sorry to see you misunderstood what I said in regard to shape of signal board. The idea I meant to convey was that the *shape* of a signal is utterly out of the mind of a person that is looking for *color*. I insist that it does not make a particle of difference what shape a red flag is, if it is seen by the party that it is meant for; that is all that is necessary; that party will stop. A three-cornered flag will stop a train just as certain as a square one. As long as there is no rule calling a man's attention to the shape of a stop board, and where a red board stops him, I contend it's not at all necessary to observe the shape. I think if you care to inquire you will be surprised to find out that many times trains are stopped by being flagged, and not one engineer in five will recognize the man that flagged him, if he should make his appearance without the flag—all he noticed was a stop flag.

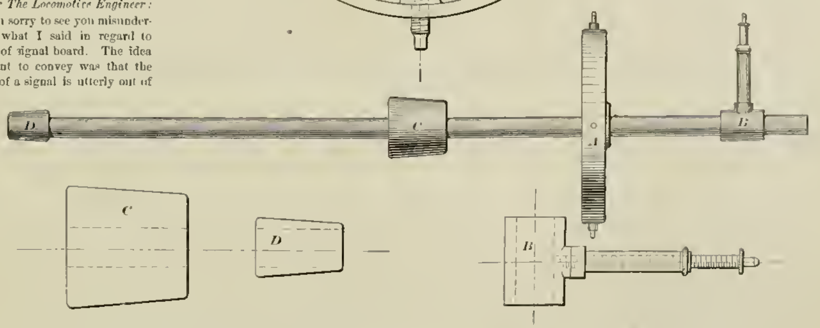
Clinton, Iowa.   WM. LANSING.

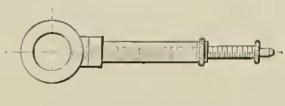
Cylinder Centering and Guide Lining—a Kink.

Editor The Locomotive Engineer:

The enclosed print represents our device for centering cylinders and lining up guides on Providence & Worcester road. *A* represents the spider or disk, which is 14" diam., with four screws long enough to fit an 18" cylinder. *B* is an adjustable pointer, which swings loose, still is a good fit on shaft. *C* is a tapering bushing which goes into the cylinder stuffing-box. *D* is a tapering bushing which fits into the crosshead. The holes through all these are the same size, $1\frac{3}{16}$ diam. to fit the steel shaft, about 5 feet long, turned as near true as possible, and a good easy fit for these holes, great care being taken to keep the shaft straight and true. Our manner of using it is to







CYLINDER CENTERING AND GUIDE LINING KINK

put the tapering bushing *C* into the stuffing-box, holding it in place by means of a strap or plate, which slips over the stuffing-box studs, put the bushing *D* into the crosshead, fasten up the bottom guides, lay the crosshead on, put the spider *A* into the cylinder with shaft resting in bushing *C*. Center the spider by means of the adjustable pointer *B*, then by sliding the shaft up to the crosshead it will easily be seen how much shimming is needed.

And when the shaft slides easily through the crosshead anywhere on the guides the crosshead guides are in line with the cylinder, and the piston can be put in and be all right.

In making this device we have tried, as far as possible, to get along without using wrenches. As you will notice on the spider, the screws are made with short, adjustable handles, that are loose, like the handle of a vise. The adjustable pointer has a knurled collar on the screw and a knurled check nut; these are easily adjusted when in the cylinder, where a wrench would be unhandy.

Providence, R. I.   WILLIAM FOSTER.

An Old Fireman of the "North Star"—Some Boiler Trouble in India.

Editor The Locomotive Engineer:

Please hold my papers till you hear from me; I am going home to England on a furlough, and will then send you my address. I was much interested in your January description of the "North Star." I want to say that the picture shows her as she now is, no doubt, but is not at all like she was when I was firing on her in 1858–9. If I remember right she and all the other "Stars" had one or two tall steam funnels on the boiler, these were for poppet valves. At that time she also had V links, or gab-motion, on eccentric rods, right and left valve gear, and in the reversing lever quadrant only forward and back nicks, or notches. The slide valves were on top of cylinders. The "North Star" at that time was a back tank engine.

I have had no end of trouble here this cold season from leaky tubes, and some of our fire-box roofs have cracked near the top tube plate angle, some of them as much as 18 inches; this class of engines have direct stays from roof to outer shell of boiler, and the weakest part has to give way. We are using very indifferent coal, which makes matters worse.

I have twenty-five goods engines on the road, and nine in the shop, so you see we are busy.

In another month, or by March, the hot season will commence, and most of our trouble from leaky boilers will cease.   LOCO-INDIA.

Nagpur, C. P.

Vertical Plane Couplings.

Editor The Locomotive Engineer:

In the *Railroad Gazette* of January 17th there is an article showing the cost of keeping up nineteen vertical plane couplers, and I wondered how much it cost to repair the damage to the draught gear of the cars with which those nineteen came in contact. I will venture to assert—for I am in a position to know—that vertical plane couplings do more damage to their own type, as well as to other cars that are not supplied with them, than any other kind of draught gear in use; and, in proportion to the number in use, they break and damage more links and pins. The so-called defunct links and pins would yield better results than any known vertical plane coupler in every respect (except, perhaps, a very small amount of closer coupling), if the drawheads were turned so that the link would be vertical; this would compensate for the varying heights of cars, both pins and links can be made secure from damage or from loosening, and the whole affair can be made as automatic as any vertical plane, and at less than half the cost. S. A. ALEXANDER.

York, Pa.

An Old-Timer.

Editor The Locomotive Engineer:

Engineer John Hawksworth, at present employed on the Chicago Division of the Atchison, Topeka & Santa Fe Railway, may justly claim to be one of the oldest locomotive engineers in active service. Mr Hawksworth commenced his railroad career in Old England in 1845, on a Yorkshire road. He came to this country in 1848 and was employed as engineer on what was then known as the "Erie & Kalamazoo," now a part of the Michigan Southern system. He was sent with an engine from that road to work on the construction of the Rock Island road out of Chicago. He soon afterwards entered the service of the Chicago & Alton, and remained with that company seven months, when he resigned, to accept a position with the C., B. & Q., and ran for that company from 1855 to 1863, when he returned to his first love, the Michigan Southern, and ran between Chicago and White Pigeon until 1866 at which time he returned to the C., B. & Q., and remained in the service of that company until 1888.

Although many years in railroad service, Mr Hawksworth is not a very old man—he is 60 years of age, and bids fair to enjoy many years of usefulness—that he can stand the "grief" of running a "Santa Fe hog" is sufficient evidence that he is still in his prime, and may he long continue so is the wish of the many friends of "Uncle Jack." L. H. G.

Chicago, Ill.

About Water Grates.

Editor The Locomotive Engineer:

I would like to hear something of the opinions of experienced men about water grates. All of our engines have them, and I think an article about the *disadvantages* of them might interest some of your readers, as we find it is about all disadvantage to firemen. Before starting, it is a job to get into the pit and hook out your grates, and with our poor coal, "Phila. mud," they need hooking out about as often as they can be got at, especially on long runs—136 miles—and it certainly is not any advantage in the amount of fuel used, as continual hooking and barring a dirty fire to get enough air through it to make steam does not lessen the quantity used, as most all enginemen will testify. We had a man come here with some new engines once, that made the remark he would not have them in a hoisting engine, let alone a locomotive. Now for the advantage. I suppose our officials will say it is a great deal less expensive to keep them in repair, as they never burn out. I know of no advantage to the men who run and fire engines with them in; some might say you never have to clean out your ash-pan, true enough. We can never get enough into it, unless it is with a new fire, when, if you are not very careful, you will get it full, and you are worse off than ever. I am not very well posted on shaker and dump grates, but I have fired them, and know that, with very dirty coal, they are an advantage to all parties, and if they are no advantage with dirty coal, they are certainly no detriment with good. A NEW HAVEN FIREMAN.

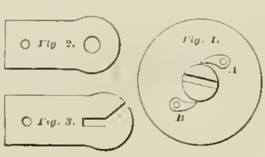
New Haven, Conn.

A Headlight Kink.

Editor The Locomotive Engineer:

Ever since I saw the description of headlight cover, that was given in THE LOCOMOTIVE ENGINEER some time ago, I have been thinking of telling you of an arrangement that some of the engineers on the Santa Fe use, that works admirably, and will be appreciated on any road that uses headlight curtains. Take a spring roller that is commonly used on window shades. Take the cap off the end that has no spring, measure the inside of case for length of roller, cut roller so that, when cap is replaced, roller will just clear nicely in case.

There are two kinds of brackets used with these rollers, one kind to go outside of window frame and one inside; get the latter; they will be something like Figs. 2 and 3. If headlight has a curtain, it will not be necessary to take it out or disturb it; put the spring roller in behind it. Fasten brackets with rivets through case. Put curtain on roller, being careful to get it on so it will roll up straight; this can be easily done by drawing a line the length of roller, and fasten edge of curtain to line with tacks or clamps. Take out "pawls" *A B* Fig. 1, so as to allow roller to revolve freely around spring. Put a light steel wire in bottom of curtain, bore ⅛ inch hole in bottom of headlight case in a perpendicular line with roller; you will need a wire to work this curtain. Take a light wire that will reach from cab to headlight—copper is the best, but common will do. Put the wire down through hole in bottom of case, out through space that is left in back of case for draught, thence back to cab, where a small hole can be made through cab sheet or cab, and wire put where it will be handy. A ring should be on this end of the wire. The wire should be of a length that when curtain is rolled up, the ring will be against the cab. Put the roller in place when you have made all the necessary arrangements, turn the roller until the spring has sufficient tension to raise the curtain quickly, then fasten wire in center of lower edge of curtain. Now it is ready for operation; if you want to darken headlight, pull down the curtain, hook the ring over any



A HEADLIGHT KINK.

thing handy in cab; when headlight is to be uncovered, unhook the wire, and curtain will go up like a flash. In stormy weather this is a comfort, is handy all the time, and don't cost much. Try it.

Newton, Kan. SANTA FE.

A Locomotive with a Peculiar Habit.

Editor The Locomotive Engineer:

There has been of late quite an amount of discussion and comment in our roundhouse and shops, caused by the unprecedented actions of one of our eight-wheel passenger engines; it is claimed by the regular runner of this engine, and has also been substantiated by other runners, who were at first incredulous, that this locomotive when traveling at the rate of fifty and sixty miles per hour down hill with throttle closed, reverse lever either hooked up or down in forward corner, would invariably slip (when rail is bad and dewy), and not catch herself until sand is given her, when she will settle down and continue the trip in good shape until the next down grade is encountered, when the action is repeated. (Frequently she does not slip but once on a trip, depending upon condition of the rail.) The engine is one of the company's make (known as the Wells engine). Wheels 60' diameter, 18x24' cylinder, weight on drivers 60,000 pounds, on trucks 33,000, tires good. Has been in service about five years, but has never until recently been guilty of such tricks. Can you, through the columns of your paper, give any reasonable solution of this, which is to us a mystery?

R. W. SIZER,
Mobile, Ala. Eng'r L. & N. R. R.

[It disproves nothing for us to say we can't believe that the engine slips under the conditions stated, simply because we can conceive of no reason for it. If it were possible, under the conditions stated, to suddenly lift the locomotive up to clear the rail, the wheels would undoubtedly keep on revolving until the stored up energy in them was exhausted. The steeper the grade the less the weight of the engine at the rail, and there is a possibility that on a steep grade and very slippery track, that if the high rate of speed of the train were suddenly checked, the water in the boiler lurched ahead, and the weight on drivers suddenly decreased, that the stored energy in the wheels might slip them for a turn or so, but we cannot imagine a case where this could happen until the slipping had to be checked with sand. There is a cause for this slip, if it really does occur, and we believe the men will find it. If Mr. Wells put this trick into the engine when he designed her, perhaps he knows something about it. If he would only design one that would slip her wheels, going *up* hill, with the throttle closed, what a revolution it would make.]

"A Cranky Injector."

Editor The Locomotive Engineer:

We have a No. 8 Monitor injector on the engine I am firing, which breaks very frequently while running, and especially when stopping (R. H. side), and no one seems able to determine its ailment. The injector mechanics all pronounce it in first-class order. The joints are all tight; strainer is kept clean, hose is tight, and tank valve has plenty of lift. It will break immediately if ram is opened over three-quarters of a turn, with feed full on, and cannot be worked with either in any other position. I see "Primer," in July, 1888, states, in describing similar symptoms, to "look to the dry pipe, which may be disconnected."

There is no other evidence to indicate such being the case on this engine, as the L. H. injector, which is also a No. 8 Monitor, will work splendidly at all times, both taking steam from same "duck's nest," as he says. It is not convenient for me to work it, however, as the boiler head comes clear back to the tank, while the injector is up ahead—hence the difficulty. Can any one suggest the probable cause of the trouble?

Oakland, Cal. WEST OAKLAND.

[It would appear, from the fact that you cannot open the steam valve full, that the instrument cannot get water enough, or is prevented from delivering what it does get. Put your left-hand injector in place of the right one; if it works, the trouble is in the instrument itself, if it acts as the right one does see that there is no obstruction in the water delivery and branch pipe; something may be the matter with the lazy cock, or feed valve; the older style plug valves were poor arrangements. Sometimes local repairers, in putting in new tubes get the steam nozzle too long, and carry it too far into the intermediate, or combining tube; this does not give the water room enough or time enough to condense the steam, and the instrument will not work; this trouble is also suggested by the fact that you cannot use a full head of steam. The fact that the injector breaks easiest when the engine is making a stop would suggest the splashing of water into the dry pipe, which will break any injector. Broken line checks often partially obstruct the pipe or boiler check and prevent a full delivery. When you find the trouble let the readers know what it was.]

To Empty Main Reservoir with New Engineer's Brake Valve.

Editor The Locomotive Engineer:

It is sometimes necessary to let all the pressure out of the main air reservoir, in order to clean, inspect or repair parts of the brake rig. With the new brake and equalizing discharge valve this is not so easily done, and the only way that presents itself at first sight, is the comparatively slow and tedious one of letting it out of the small pet-cock on the drum.

By taking off the nuts on handle stem, and turning the handle over, the valve can be turned clear around, one-third of a turn past the emergency stop will open full and direct communication from the drum to the atmosphere, and bleed the main reservoir as quickly as can be done by the old 3-way cock. BEN DIGGORY.

Pueblo, Col.

Cleaning Dope for Brass.

Editor The Locomotive Engineer:

Thinking some of the boys would like to know how to make some good polishing dope, which can be got up cheap, I will send a receipt which I have used with success:

6 sperm candles,
1 pint signal oil,
1 oz. gum camphor (pulverized),
½ oz. arsenic,
¼ bath brick (powdered),
½ pint ammonia.

Melt the candles in the can you intend to keep the dope in, then stir in the other ingredients, the bath brick last. This makes a good polish for brass, especially if warm.

A. W. MASON.

Tulare, Cal.

[This is just the kind of "kinks" the firemen are after, let's have more of them.]

That Scotch Locomotive Test.

Editor Locomotive Engineer:

I have to thank you for the copy of THE LOCOMOTIVE ENGINEER for February, which contains reference to the proposed sending of a representative American express engine to the Edinburgh International Exhibition of this year. In next week's issue of the London *Engineering* and *The Engineer* you will find further correspondence on the subject.

It is greatly to be hoped that you will immediately take steps to obtain subscriptions on your side toward the guarantee fund which is proposed to form for the purpose of reimbursing the Baldwin Company, the expenses incurred in sending one of their engines.

The exhibition will comprise five of the best English express locomotives, including two compounds on different systems. If Americans are sincere in their estimate of their engines, this is an opportunity of showing what they can do, which should not be allowed to pass. On the opening day of the exhibition a train is to be run from London to the exhibition (400½ miles) without stopping.

GEO. E. WATSON, Sec'y.

Edinburgh, Scotland.

[Not only the Baldwin, but most of the other locomotive works in this country are abundantly able to send a locomotive to Great Britain for trial, if they considered it would pay to do so, and would no doubt decline any charity in the shape of subscriptions in the matter.

All the principal locomotive works in this country are at present very busy on orders, and perhaps prefer to build for money instead of glory. As we said in a former article, the winning of this test would only amount to an advertisement for our work in some of the South American countries.

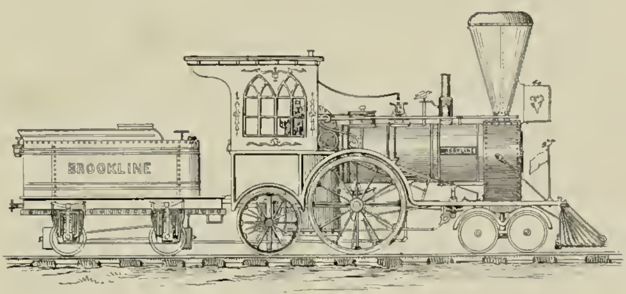
It is not necessary to build a special locomotive for this trial; what is the matter with sending one of the "class K" of the Pennsylvania—say the "long-legged ten"—over there? We should like to see a representative American locomotive in this test, and believe that one would not come out at the tail-end of the string. In this country our fast trains are heavy, but do not make the time the English expresses do, though they pull much lighter trains. American locomotives have never been beaten in trials with other builds in North or South America, or any other country, and we see no reason to fear that they would lose the belt the coming bout.]

One of the Old Stock.

Editor The Locomotive Engineer:

The enclosed photograph of the "Brookline" may be interesting to your readers, so I send it, with an outline of her history.

This engine, originally named the "Lion," was built at the "Bury Works," Liverpool, Eng., in the year 1835, for the Boston & Worcester R. R., now Division No. 1 of the Boston & Albany R. R. When first put in service she was without cab or truck wheels, and on the occasion of having the first cab, the directors found considerable fault, as it was thought the engineer could not see as well as before; her cylinders were 10"x18", the drop hook valve motion being used; her weight was about twelve tons; in the year 1846 she was taken from regular service, and only ran occasionally till the year 1852, when she was used in building the Charles River Branch, which is now part of the Woonsocket Division of the N. Y. & N. E. R. R.; work being commenced at a point where there was no rail connection, she was drawn across the country from Newton to Newton Highlands, some two or three miles, by eighteen horses, as well as the tender and construction cars; after completing this work of construction she was taken into shop of the Boston & Worcester R. R. at Boston and overhauled, and truck wheels put in place of small wheels, which were put in rear of driving wheels (as seen in picture); she was then named Brookline; in 1853 she was put on the Brookline trips, in which place she continued to run for twelve years, being run by Mr. J. M. Alger, who is still running on the B. & W. Division of the Boston & Albany R. R. About the year 1866 she was laid by, and, after passing through various hands, was named "Farmingdale," and sold to some eastern road; during the thirty or more years she was in use by the Boston & Worcester R. R. she ran over 700,000 miles, or more than any other locomotive up to that time in the United States.



ONE OF THE OLD STOCK.

The Boston & Providence R. R. had an engine like her, built by same firm, and about the same time, named the "Roxbury." Neither of these engines when built had steam gauges, their pressures being told by the old fashioned spring balance; the first one, the "Lion," had a mercury gauge, put on by the engineer. the fire-box was quite small, a large armful of wood almost filling it—that being the fuel used; the fire-box was circular, as was the shell which enclosed it.

Boston, Mass. H. L. HOLMES.

A Fireman's First Trip.

Editor The Locomotive Engineer:

I enclose an account of my first trip over the Missouri Division of the N. P. R. R. We are using Red Lodge coal here now, and firemen have an easy time compared with what they have had.

Like many others, my first firing was done on a switch engine, and after I had fired her three or four days I made up my mind that *I* could keep most any kind of an engine hot. And right here I would like to ask why master mechanics and others seem to have that same idea that I had, and think any man ought to be able to keep an engine hot after three or four days on a switch engine, when really the man has not had a chance to learn the first principles of firing.

I would like to see a change made, and see men sent out on the road with an experienced fireman, and given a decent start at their trade. It will be money in the pocket of some railroad company that will try it.

Well, as I said before, I thought that *I* could fire most anything, so I felt pretty good when I was marked up to go out on the 318. We had a tank of Pittsburgh coal out of Dickinson, and the way that engine stayed hot would have tickled the firemen of the hot place to death.

When we got into Glendive, some one asked my engineer how I got along, and received the reply, "Good"; "will make a first-class man," which did not injure my self-respect at all.

Coming back we had a tank of what the boys called "Bull Mountain," a *kind of coal* that comes from the top of the eastern range of the Rockies It is fine coal, so fine; in fact, that when the wind blows it is a question whether it reaches the fire-box or blows out of the gangway.

We had a full train as usual, and I did first-rate for seven or eight miles, and then the pointer began to drop back. My engineer shut off the injector, and she picked up slowly to 140, when the injector was put on again, and there began a struggle to see whether that pointer should stay where it belonged or not.

I kept her at 140 for fifteen or twenty minutes, and then she started back again.

Up to this time I had been firing very carefully—only one or two scoopfuls at a time—but now I began to get desperate, and put in three or four at a time; and the more desperate I got, and the faster I put it in, the faster that pointer went back, until it had settled to the neighborhood of ninety pounds. About this time I went to put in a scoopful of coal, meaning to drop it just under the door; imagine my feelings when I found that it would not drop, but that *that* fire-box was full right up level with the door! I turned my scoop over to look at my fire and found as neat an imitation of the Dakota Bad Lands as could be made without practice.

I went out on the back end of the tank and got the ash-hoe and leveled down some of the Buttes, then let them burn awhile, then stirred them up again, and kept this up three or four miles with once in a while a scoopful of fresh coal until we stopped for water; there we cleaned our fire, and then we repeated the performance, and we repeated it four times during that trip

After I had fired a trip or two I noticed that if a scoopful of that coal was thrown in one place without scattering, it would make a clinker, and I found that when the fire-box filled up, all but six or eight inches of its contents would be dead ashes; so I figured If I scatter my coal so that those clinkers will not form, and keep those dead ashes shaken out of the fire-box into the ash-pan, where they belong, I will have the best fire I can get from "Bull Mountain." I tried it, and I have not had to clean any more "Bull Mountain" fires

Since I made that trip I have learned some other things about firing, which I should be glad to tell for the benefit of young firemen, as I presume that any old fireman knows as much or more than I do.

AL. K. LI.

Dickinson, Mont.

LOCOMOTIVE ENGINEER.

THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS.

About Keeping Up Pay.

On a recent visit to the South the writer stepped into the Savannah roundhouse of the Central Railroad of Georgia, and found a little knot of men gathered at the train board, and a discussion going on—animated discussion is always of interest.

One man had a dinner pail, and he was rather sassy and independent to the other who had none—men *with* are often patronizing or sarcastic to those *without*.

The man with the pail was an engineer, the man without, the master mechanic, and the talk was caused by the fact that the engineer had just come down to go out on a train due to leave two hours or so before; the transportation department were kicking to the M. M., and he to the engineer.

Shortly after our arrival on the scene the discussion ended up something like this:

M. M.—You know that it has been the custom here for years for the engineers to come and examine the board every afternoon; no calling is done in daytime; as per your agreement. You had more than twenty-four hours' rest, and should have come—why do you make all this delay and kicking from the superintendent's office?

Engineer. I didn't feel like coming down last night, didn't have any one to send but my children, and thought I wouldn't get out till now, and I don't care much; what's the hurry about this train, anyway?

Another engineer stepped up when this one went his way, and reported himself over the grip and ready for duty.

All right, said the M. M., want you to-night on train so-and-so—designated by number.

The engineer kicked, said he didn't suppose he would have to go out before the next night—still he had reported for duty.

This was an interesting state of affairs, and we proceeded to "get acquainted" and find out the cause—wanted to know why a man did not want to go to work when he had just reported for it.

We found that the engineers on this road have the best agreement—for them—with the company, of any engineers in the country, the full text of which is published in another column, under the head of "The Best Agreement in America between a Railroad and its Engineers." It is interesting reading.

"These men receive $4 per day, Sundays included, whether they work or not; they get twenty-four hours' rest after each trip, and if called to go out before the twenty-four hours are up get an extra day for going.

They receive twenty-five cents an hour for all delays over schedule time, or twelve hours when running extras.

Hostlers are provided at all terminals.

They receive pay from the time they *report* for work after laying off—instead of from the time they go out, as on other roads.

With all this advantage over their brother engineers in the same section of country, we never listened to better kickers in our life—perhaps we got into the wrong crowd—we hope we did.

No one can accuse us of ever trying to reduce pay or remonstrating against the size of any engineer's check, and we are only too glad to record a case where a large road is so willing to pay their enginemen well and give them long hours of rest. If this contract is broken it will be because of the dissatisfaction of the engineers, and the annoyance they are giving the officers of the company.

Four dollars a day is the standard pay of locomotive engineers, it is fair and reasonable, but we heartily wish it was six instead of four. One hundred miles is considered a day's work in all parts of the country.

Other roads in the South are paying $4 for 100 miles, and the men consider that they are receiving standard pay. The engineers of the Rock Island just suffered a cut of fifteen cents per day to bring the pay of the whole line up to $4, or standard.

Wishing to impress upon the Georgia Central men the desirability of nursing what they have got, deserving it, doing such good work, and in so cheerful a manner that their pay and their close relations to the management of the company will stand as a pattern to the rest of America—we draw some comparisons.

From Savannah to Macon it is 190 miles; in the month of January there was made on this division 78,452 miles by freight engines, there being in service forty engineers. These men drew $124 pay, and $3.30 each extra pay. This is only 1,961 miles each for a month's work. Had they been running on a mileage basis for standard pay, they would have received but $78.45 each.

In February only 68,118 miles were made, and there were forty-two men; this month their pay was $112, but their extra pay was $14.67 per man. Had they been running on a mileage basis with full pay their checks would have been less than $65 each.

Suppose the Central road should offer to pay half a cent a mile *more* than standard pay, could the engineers of the country sustain the men in a resistance against the cut?—for it would be a cut on present pay.

If a mileage basis were adopted just about half the engineers on this road would be out of jobs—for the older men would want about $120 worth anyway.

The management of the road are satisfied to pay the present rate, and do not want to see a change in the agreement—don't force them to make one. It will be mileage, sure.

The grievance committee is too easy to get out—let it rest. An engineer on this road recently ran a locomotive with a hot eccentric till the strap broke, ran with the main pin so hot that the brass stuck to the pin—abused the engine. Instead of discharge or 60 days, he was put back on freight; he ought to have considered himself lucky; but the grievance committee went to the general manager and asked his reinstatement—and did not get it; some discipline is necessary.

Engineers of the Georgia Central, you are better paid for the work you do than most engineers; be an example to them—deserve that pay. Don't let it be written in the history of the order that you kicked your own wages down. Don't give the officers of the road a chance to regret the agreement or desire a change. Don't forget that, as you receive the highest pay, so had you ought to be the best engineers in America. Don't get it into your heads that other men cannot run there; there are few who can't. Don't kill the goose that lays the golden egg. Don't be unreasonable or unjust—you cannot afford it.

All this is said in the kindliest spirit, and to help, not to hurt you—advice from one engineer to other engineers.

In traveling about the country we note with care the condition of enginemen, what advantages they enjoy, what burdens they bear. You have jobs to be proud of—be proud of them.

A Comparison.

A locomotive engineer might well be likened to an artillery marksman. He knows very little about building his gun, but he can repair slight breaks, or use it partly crippled. He cannot figure out the velocity of the projectile, but he can hit the mark with it. Both the marksman and the engineer use the machines in their hands as a means to an end. The execution done depends upon their skill, and the quality and condition of the device in hand.

Locomotives earn money for their owners only when they are in motion—moving cars—then the man who can move the most cars for the greatest distance, with the most safety and least expenditure of money, is the best marksman—he hits the bull's eye.

The scientist and the savant, who can figure the projectile's velocity, the recoil, the gas pressure in the gun and the spiral of the rifling, is not the man sent to battle to do execution with the engine of war—the marksman goes.

The scientific man was useful in building the gun, not in thumbing the vent or swabbing the piece.

Men who can figure out all the theories, and who know all the rules about steam engines, who can tell the strength of all the materials, the names of all the gases, and prove that the cylinder stack and nozzle want to be all one size, are not the boys who make a success when they try to run a locomotive that is subject to chills over a hilly road with a heavy train, and be on time at every fish-plate—the engineer does that

Successful locomotive running is marksmanship, of the Creedmore order. Be a marksman.

A Valuable Book.

The *Engineering News*, of this city, one of the best high-class journals on the continent, recently issued in supplement form, a large map of the U. S., showing by colored lines, the roads using automatic air-brakes, and by another color those using automatic couplers of the M. C. B. type.

This plate was accompanied by a table, showing the number of roads using the devices named, the miles operated with and without the brake, and the total number of cars equipped.

The condition of the equipment is fully discussed, results of tests shown, etc.

The Westinghouse Air Brake Co. have complimented our contemporary by issuing this piece of work in pamphlet form, which they are sending free to those interested in the subject. Send for it.

ASKED & ANSWERED.

(20) Brakesman, Leavenworth, Kan.

You can find the full name of any railroad in the United States, in Poor's Manual of Railroads, published by H. V & H. W. Poor, New York. S. of M. or S. M. means superintendent of machinery; S. of M. P., superintendent of motive power; when & R. S. is added to the latter, it means, "and rolling stock."

(21) Fireman, Argentine, Kan., asks:

1. How is the proper location for a rocker-box determined? 2. Why does reverse lever tend to pull in direction engine is running when working steam? Please answer through columns and oblige. *A.*—There is no particular place to put the rocker box; the build of the engine often determining its location. 2. The friction between the eccentrics and the straps causes the lever to pull in the direction the engine is running; the slip of the link on the block causes the jerk.

(22) W. A. J., Baltimore, asks:

1. Will you please tell me in your paper how driving wheel tires are made; and, 2, what you think of this. A machinist told me that he always keys the side rods on back center and finds them loose on front center, and if keyed on front center will find them tight on back center. *A.*—1. Driving wheel tires are rolled. 2. There may be a slight difference in some cases as stated, but it is not the rule; it is caused by slight difference in pins or driving-boxes, and side rods should never be keyed close enough to show a bind. Nine out of ten are keyed too tight—they fit too well.

(23) B. G. D., Charleston, S. C., writes:

We have a great deal of trouble in our boiler department in flanging steel boiler heads, more especially the round head on front end. In flanging they bulge or raise up in center of head. The boiler makers straighten them by pening or with a tool they call a fuller. I think this injures the material, and I am satisfied that the pening crystallizes the steel and makes it brittle; but the boiler makers say not. Can the bulge be prevented or removed by other means, and what causes it? What book treats on this subject? *A.*—In flanging by hand a round head there is always a tendency to slightly bulge the head, and it is usually straightened in the way mentioned. If the sheet is hot there is no danger of injury to the steel. In machine flanging no trouble is found, as the die or ram of the machine holds the center of the plate down solidly while the flange is formed. "A Manual of Steam Boilers," by Thurston, or "A Treatise on Steam Boilers," by Wilson & Flather, are considered the best and most recent works, both published by Wiley & Sons, this city.

(24) P. M., New York, writes:

1. In page 200 of Forney's Catechism of the Locomotive, in answer to Question 290, Mr. Forney says the driving boxes "are arranged so as to slide up and down in the jaws." I am informed by an A 1 machinist that the driving boxes are stationary, and frame and wedges work up and down instead, please decide? 2. In page 13 of January number of your paper, under heading of "Elementary Lessons in First Principles," your correspondent says that hooking up link motion is equivalent to moving eccentric on the shaft, will you please explain how this applies to back motion? *A.*—1. When a locomotive rolls, the jaws, together with the frame, move up and down on the box, but when a wheel runs over an obstruction or into a depression, the box moves in the jaw. 2. To increase the lead, it is necessary to advance the eccentric on the shaft, *in the direction it is to run;* when you hook up, going ahead, you do not advance the eccentric, but you move the line of motion back on it, which amounts to the same thing. In backing up you do the same thing—move the motion back—practically advance the eccentric on the shaft in *the direction the engine is running.* See illustrated article on subject, on page 5, February, 1889.

(25) J. W. Peterson, Boone, Iowa, writes:

We have been working on two air brake questions for some time, and to find out whether or no our conclusions are correct they are referred to you or the readers of your paper. Both questions have come with the advent of the brake valve of '88 with equalizing discharge. What we want to know is: 1. "Why, when the handle of brake valve is thrown to release position after an application, there is often a blow from service stop exhaust port for a longer or shorter time, depending on the amount of reduction. 2. Why, when making emergency application, both pointers on the double gauge assume the same position? Westinghouse experts have answered the last question by saying that the rush of air from rear of train is so rapid in an emergency application that it forces the hands up to same position. Hope some one will be able to explain satisfactorily. *A.*—1. When the valve handle is thrown from service to full release the air from the drum rushes through the large open ports and commences to fill the train pipe, and also passes through the very small ports to the top of the piston of the service stop valve; the air, having been reduced in the service stop drum, does not instantly regain its pressure, and the rush of air into the train pipe and under the piston of the service stop valve holds it up until the pressure equalizes; this, of course, allows air to escape at the service stop port for a period, more or less, according to reduction made; often this is augmented by the piston of service stop becoming gummed and slow to act. 2. When the emergency is used the gauge is entirely cut off from both the engine drum, the train pipe and the service stop drum. If the valve handle has been standing at full release, both pointers will be together, and an emergency application simply cuts off the pressure to them and leaves them there; if the handle has been at running position, the pointer showing the pressure in the engine drum, and the service stop drum will show most pressure; and when an emergency stop is made the only way we can see to account for bringing the pointers to the same mark would be that the movement of the handle past the service stop had reduced the pressure enough to account for the movement of the pointer. If everything is tight this had not ought to occur. The fact that, with the new engineers' brake and equalizing discharge valve, the gauge is shut off from all working pressure in an emergency stop, has scared a good many men, who thought that the brakes were not applying because the pointer did not indicate a reduction of pressure. This fact is not well enough understood.

IN THE ROUNDHOUSE AND REPAIR SHOP.

On the East Tennessee, Virginia and Georgia.

The East Tennessee, Virginia & Georgia Railway owns 1,006 miles of road, and controls in all 1,624 miles, operates over 200 locomotives, over 6,000 cars, and earns between five and six million dollars yearly, being considered one of the best roads in the South, and as there are some 300 subscribers of THE LOCOMOTIVE ENGINEER on the line, I thought it worth a visit. On the last day of February, I packed my grip, and took a corner in a Pullman, with a ticket in my pocket for Knoxville, Tenn.

AN INCIDENT.

When I go off on one of these little trips I make it a point to notice everything that has a railroad point in it, and in this case I only had to wait four minutes for a subject. A lady entered the car, and seated herself near me, just as the train started, she had come out of the coach, and had passed the conductor who was on the station platform. The Pullman conductor approached her, and asked for her ticket, she handed him her coupon ticket; he wanted the Pullman ticket, but she had none. She defined what a first-class ticket called for, and said the ticket agent in Boston had told her that her ticket called for "everything," "all modern conveniences," etc., and no one could tell her that modern conveniences did not include sleeping car. She asked if the conductor called that passenger car first-class; was there a place to wash? A ladies' dressing room? Did they even have a towel in them? couldn't any one come in and demand half the seat? etc., etc. Both the lady and the conductor were cool, polite and respectful, but firm and determined, in vain did the conductor tell her that she must always buy a separate ticket for a sleeper, that Pullman had nothing to do with the road, and that railroad tickets were simply for the ride, and Pullman's for the trimming; and it was an hour before she finally put up $2 extra for a berth, and then only after taking a receipt for it, and declaring that she should demand it back of the agent who had deceived her.

All day on the first of March we rode through the historical Shenandoah Valley, skirting the southern slope of the Alleghanies. All through Virginia the valley is wide, with well-cultivated farms on every hand. From Hagerstown, Md., to Bristol, Tenn., I went over the Shenandoah Valley road and the Norfolk & Western, striking the eastern terminus of the E. T., V. & G. at the latter point.

KNOXVILLE, TENN.,

is the headquarters of the road, and is a rather lively little city, situated on very hilly ground, in the center of the great marble-producing district of this State.

The motive power of the East Tennessee road would attract the attention of a railroad man anywhere, not because it is odd, or antiquated, but because it is modern, up to date, and shows care and attention in its maintenance, that speaks well for the shops; a degree of cleanliness and order that notifies you in advance just about the kind of enginemen you will find, and a uniform appearance and sameness of outline that says, before you think of it, "This must all be under one head that is striving to maintain a standard—there must be a superintendent of motive power here."

IMPROVED CONDITIONS.

The railroads of the South were for a long term of years the worst on the continent, dilapidated, run down, with all kinds of second-hand motive power and rolling stock, and only two streaks of rust and a right of way for a track. This has changed now, and some of the best modern locomotives and cars in the country are running over rock-ballasted track in the South. The East Tennessee road is one of the roads that has fixed up everything, but

THE SHOPS.

Any mechanic or railroad man familiar with running repairs would be surprised to go through the shops of this road after noting the general good condition of the power; and there is but one explanation, and that is the use of ability and brains in getting much out of little, and making order out of chaos.

The Knoxville shops are simply a row of old sheds in no way adapted to the work, and the roundhouse is worse, built before the war, for little engines, it is still used, and the modern 18 x 24 locomotives reach clear through it and stick out at each side; it has no drainage, and water from the pits runs into the turntable pit, where the sediment and mud is removed on push-cars. The shops are separated from the roundhouse by the passenger depot and yard, and the shops themselves have been built piece-meal, without any apparent plan. What Mr. Thomas and his assistants have done with this plant is a surprise to outsiders, and ought to be a source of much satisfaction and pride to the officials of the company.

NEW SHOPS.

The foundations are in for new shops outside the city, and I was told that these were going to be modern and first-class in every particular, but it is an odd thing that the management of roads will only put up decent shops, after every other known improvement has been made in the shape of buildings.

THE POWER.

There are yet in service but a few old engines on some light work, most of the power is new, of Baldwin or Schenectady build, with standard parts of Mr. Thomas' design—were it not for the name plates on the smoke arch, it would be very hard to tell one make from the other.

All of them have extension smoke arches, and short, straight stacks; they are painted black, lettered in yellow, and the strips are left off.

TENDERS.

As fast as they go into the shop, the flange on the back of tank is cut off for about one-third of its length, and run across the back on top of the water space and ahead of the manhole, then a neat hand-rail is run around the back and sides, giving the "hurricane deck" a finished appearance. This allows the water spilled in filling the tank to escape to the ground, prevents the lodging of cinders and the rusting out of the top sheets of the tank.

The tenders have heavy iron frames, and, in some recent collisions, some of these frames were driven full length into heavy cars without breaking them up to amount to anything

Heavy, triple arch, diamond trucks are used under all tenders; these have short arches, getting the wheels close together, they use the standard M. C. B. box of the Pullman type, and are using a solid-end stop. On some of the new ones the Westinghouse hollow steel brake beam are used.

A GOOD CHECK

A large cast-iron check case, that reminds you of the old pump check, is used, and known here as the Thomas check, all the men speak well of this check, and say that since its introduction on the road their leaky and stuck checks have disappeared

BALANCED VALVES.

Balanced valves are used, and we noticed some with the entire back of the valve cut out, but this did not work well, and valves with a back on them are being substituted, as the engines having them in come to the shop.

A ROAD KINK.

Iron signal flags are used; these are small, perhaps 10x14, and painted the proper color; on the back edge of flag there are riveted two loops that drop over iron flag-staffs fixed permanently on the pilot of every engine When the flags are not in use they are placed in a tin pocket, of the proper size, that is fastened to the outside of the back of the headlight

INJECTORS OUTSIDE.

Injector steam pipes are tapped into the dome, and there is nothing of the injector or piping inside the cab, except the operating handles.

A STEAM BOX

is used in the cab, this is a plain box, set up well off the boiler head, and having all the steam cocks in it except the gauge cocks and water glass This box is plain, and carries everything on it, and is so arranged as to be easily cleaned. By closing one large valve to its dry pipe any cock can be taken out and ground while steam is on

NOZZLES.

They have excellent coal here, and extra large nozzles are the rule, consolidation locomotives using 5¾ and 6 inch right along, and 8 wheelers using 4½ to 5. I had a great deal of conversation all along the line of the road with engineers and firemen on this subject. In every instance they told the same story: "They steam all right with the best coal, but if it is poor they are hard steamers."

This road, like many others, keeps a coal reserve, and engines are required to burn coal, about half the time, that has slaked for six months or a year on some chute or the ground.

I am a big nozzle man myself believe in running just as big a nozzle as an engine will make steam with, using *average* coal. My experience as an engineer and a fireman have proven, to my own satisfaction at least, that where a nozzle is so large that steam cannot be easily maintained with a medium quality of coal, that the fireman will use more coal in shaking and poking at his fire to get the best results out of it than is saved by the extra opening of the nozzle "Fighting the fire" wastes coal, keeps the crew in bad temper, causes runners to take unnecessary chances in "petting" their engines for water, and distracts the attention of the engineer from his more important duties with the throttle and the rules of the road

Just as quick as one of these engines starts off you notice the sound of the exhaust and know there is a great, big, generous nozzle in there I like to hear it—it sounds economical—but I have heard it when there was only a little wet steam in the lower gauge, and twenty cars and ninety pounds of wind were making me wonder how I was going to make a siding for the express. I did not like the hollow mockery of its laugh then, and would have given something to have choked it down to half—then and there.

WEDGE AND CELLAR BOLTS.

In going through the repair shop I noticed that they use but one of the two small wedge bolts, used where there are cast-iron thimbles between the lower end of pedestal jaws, have no trouble with their staying in place. For cellar bolts on driving boxes a very large split key or cotter is used.

CHAFING IRONS.

There are no makers of locomotives in the country that put heavy and large enough chafing irons between the engine and tender, the wedge is usually three or four inches wide when it ought to be six or eight and proportionately strong, with a chilled face. This part of a locomotive is usually changed to suit different ideas, and meet the requirements of the work; on this road they are putting on extra large wedges and chucks of their own design.

A SAFETY STIRRUP.

On pony trucks they put a heavy loop of inch-square iron from the cradle of the truck around the long equalizer. If the center pin bolt in front breaks, the long equalizer simply drops an inch or two into the loop and is safe, and does not rest on the axle, this accident happens very often on consolidation engines, and is dangerous and annoying. With this arrangement there is no necessity to stop when the pin breaks, much less to jack up and block up. They have had trouble here with the hole in back end of radius bar wearing large, and are improving them by doubling the thickness there and enlarging size of pin

SOLID ROD EXPERIMENTS.

Solid-ended rods are in use to a great extent, and good results have been had by boring out the brass from an eighth to a quarter of an inch larger than the pin, except a ring at each edge of a quarter of an inch, and filling the whole face of the brass with Magnolia or American metal. This has worked very well, but I should be afraid of it in case the soft metal should melt out—which it is prone to do—in that case it would mean a job of disconnecting, if the trouble was with the main rod.

It has been found here that the main bushing for side rods on consolidation engines wore out the fastest by half, and on some new engines of this class there will be solid-ended rods, except the main connection, which will have a strap and half brass box and double keys, to facilitate keeping the connection of the proper length.

SOFT METAL BEARINGS

Crossheads are lined solid with block tin; I see this used for crossheads in many places, and always with good results.

Car brasses are made in the shops, are cleaned out with an emery wheel and lead-lined.

Half shell driving brasses are used, but nowhere on the road do they use any soft metal in them. In this shop the top of brass has three recesses about half an inch deep and wide nearly across the brass —one at the crown and one at each side—these recesses communicate with the oil holes in the casting of the box, and from these are drilled six holes through to the face of the brass It is claimed that there has never been a case reported where all these holes were found stopped up at the same time.

EXPOSED STAY BOLTS.

Periodical examination of all stay bolts is made, and in order to do this the lagging and jacket ends on the side of wagon top on a line with the top row of stays to the side sheet, this leaves a bare spot in front of the cab that looks odd, but when kept nicely blacked does not look at all badly. On consolidation engines and others where boiler comes through the cab, there is a section of lagging and jacket, bound by light angle irons, that can be lifted out of the way by loosening a few bolts; this provides for the examination, and does not roast the occupants of the cab.

NO MONKEYING IN THE FRONT.

It is an offense punished by fifteen days' suspension for an engineer or fireman to open a front end, except in case of accident on the road; this rule had to be adopted to stop the changing of nozzles, cutting of draught pipes and distortion of deflectors and nettings.

Some of the engines have U S. metallic packing, but most of the freight engines have the old stuffing-box. Several engineers asked me why the U. S. packing was not made any more, they seemed to have an impression that it was out of the market A new form of metallic packing, designed by one of the L. & N. men, is being tried, and the chances of success look favorable.

DRIVER BRAKES

Eight-wheelers have the "push-down," spread, driving brake, and the freight engines either the vacuum or the American, with the equalizing pressure rig for six and eight-coupled engines. They have the same trouble here I hear of every where—all brake hanger rig for freight service too light, hangers and pins constantly breaking, and the shaking of the rig when brakes are off wears the hangers, and makes the whole rig trappy and weak.

Freight mills have a large ventilator in the roof of cab. All steam gauges are tested monthly.

MACHINE TOOLS.

In the shop there are a good many good tools, and some that it will hardly pay to move to the new shop; still it is a dearth of tools instead of a stock of bad ones from which they suffer. The machine shop has a fair equipment, the blacksmith shop is not well equipped, having only one steam hammer, and that not the best or latest design. The wood shop has some good tools, but the big planer is about all the old, plain stationary engine ought to turn; but she has that to do and all the rest of the plant beside; the erecting shop is an old roundhouse, and does very well for that purpose temporarily. The greatest objections that I have ever seen to

TEMPORARY SHOP

arrangements are that they last too long. The average railroad management build shops "that will do" when the road gets about twenty-five locomotives, and want it to "do" till they have 200. To the average "manager" who is trained in the transportation department, or the school of barter, all locomotives are made of iron, and all ought to do the same work, regardless of circumstances.

SMALL TOOLS

In the tool-room there are a few machine tools, but not the best for the purpose, and a good many hand-tools developed there for their work that are invaluable. They make their own flue expanders on a pattern designed by the tool maker, and there are many small tools about with his ear-marks—one is a tap to thread holes for the bent tubes that support brick arches in fire-boxes, in which the thread on the pipe itself is made to guide the tap.

ROLLING STOCK.

The passenger cars of the system have the Janney coupler, automatic brakes, whistle signals, and are fairly up to the standard; they use a pop valve, set and sealed at fifty pounds, on the pipe between the auxiliary drum and the brake cylinder, to prevent the sliding of wheels; freight cars are heavy, but with plain draw gear and brake shoes on but one truck; their 4-wheeled cabooses are the heaviest and best I ever saw; they have a solid frame and rigid drawheads, like a tender, and can stand all the pushing a consolidation can give.

The number of broken cars on the repair tracks is a fair indication of the volume of business, and these are full; heavy trains pulled over a hilly country on a crowded, single track calls for lots of break-in-twos, and rear end "circumstances," and more and more shows up what automatic brakes would do to preserve things in their proper shape.

HOW MANNED.

Mr. Thomas and most of his master mechanics and foremen are graduates of the P. R R., Mr. Thomas having learned his trade at Renovo. The Knoxville shops are under the care of the following staff: J. B. Michaels, division M M , with the following foremen: J. P. Clare, machine shops; R. J. Farrel, erecting shop, R. D Simpson, tin shop; J. A Jamison, boiler shop; F. A. Cummings, blacksmith shop; A C. Rourke in the roundhouse, days, and A. J. Dunn at night; T. P. Roberts is the tool maker, J J. Bossinger M. C. B., Frank Smith foreman car painter, Wm. Ham foreman carpenter, and John Householder has charge of woodwork on locomotives.

The engineers and firemen run 100 miles for a day, and there is no graded pay—the first day a man goes over the road with a train he is paid full pay. Thirty-five cents per hour is paid for delayed time. Hostlers are provided to receive engines as they come into the yard, and put the train away and take engines to the house.

IMPROVED WORK BOOK.

Blank forms are provided to report repairs on, and a place is left for the man making repairs to report work done, and charge his time; thus a record is made of work reported, that done, and that left undone, and the whole thing is copied and sent to the Supt. of M. P. This plan has many advantages over the old work book, where all work reported is crossed off, whether done or not, and many a man has unjustly lost his job over the work book. There can be no dispute with this plan—it is a good one.

DEPUTY ENGINEERS.

At the roundhouses men are provided to pack, clean signal and headlights, and do other work usually done by the engineers, as the freight engines are "chain-ganged," no crew having a regular engine.

ON THE ROAD.

Through the courtesy of Supt. Huger, I was treated to a ride on the 217, one of their best passenger engines. We left Knoxville in the evening but an hour or two before dark, and I had a chance to see the condition of the road. The line is built over uneven ground and is pretty crooked for a standard gauge; the line is laid with fifty-six-pound steel, and rock-ballasted, with modern bridges in most places and good station buildings.

A FAST RUN.

Engineer McNab, of the 217, is a cool, jolly runner, with a pride in his engine and his work. It was he who, a few months ago, took Jay Gould's special cars over this crooked division in such a hurry—making 112 miles in 107 minutes.

AT CHATTANOOGA

the East Tennessee road have only a yard and turntable, and it is not a very good yard either, but it does very well. Our correspondent, H. T. Hooker, is in charge here as general foreman; has a car fitted up for an office, a car for a storehouse, and a car for a shop. It is under such conditions that kinks and short cuts are devised for work, and the best there is in a man brought out.

SAVING OIL.

A great deal of the work here is the oiling, cleaning and caring for the passenger cars; and one fact is worthy of note—they use more oil for illumination than for lubrication, ten barrels of burning oil being used to seven of lubricating. Nowhere on the road is oil furnished to car repairers or train crews to pour into hot boxes and run off, packing waste, thoroughly saturated with oil, is furnished; this cannot be put into a box on top of what is there already; the old packing has to be removed and fresh substituted, and better results with less oil are accomplished.

SAND

of a good quality seems hard to get—it is too fine. At Chattanooga they use two Big Sandy driers, and they dry more sand than any device I ever saw for the amount of fuel consumed and surface exposed, the secret of their efficiency being in the fact that the moisture evaporated can escape at once to the air instead of having to be forced through eight to twelve inches of wet sand. A car a day is no big job for these driers.

ATLANTA SHOPS.

The Atlanta shops are the best ones that I saw on the line of the road, they are located some two miles from the center of the city, on high ground; the main shop is a long square building of one story, the offices and store-room occupy a separate building, and a new roundhouse is located conveniently near, the car shop burned about a year ago, and the blacksmith shop suffered the same fate about three months since; a temporary blacksmith shop has been built, but the car-work is all done in the main shop. The yards about these shops are clean, and are kept in order; there is room and no crowding, but, aside from the roundhouse, which is a first-class one, the shop is not well designed for a railroad repair shop. A railroad shop, in which it is necessary to keep in repair the motive power and rolling stock of several divisions of a big road, should have separate stalls, so that engines can be taken in and out without disturbing other work; this shop has four tracks entering the end of the building, and locomotives are put in one behind the other, and it is easy to see how this can inconvenience their handling, let alone the absence of that get-at-ability that is had with the separate stall plan; there was plenty of room in this case to get the work in and out without the use of a transfer table, which would have made it cheap.

The shop is only moderately well supplied with tools—some old, some new. There are several rigs of their own make, one especially for turning eccentrics, another for finishing and grinding rods, that are interesting and efficient.

A coach was being rebuilt on one track, and engines on another; as it is necessary to paint the cars in the shop it is disagreeable, as the shop must be closed to keep out dust. I believe there is a plan to put up a new car shop here this summer.

I noticed that on some of the freight engines a heavy weight is attached to the long arm of the vacuum driver brake, to hold the rig still when off, and prevent its shaking.

Driving brasses are put up without babbitt, but only two oil holes are drilled in the brass here.

THE PILOTS.

The pilots are like those described on the Fitchburg, where the draught casting is not attached in any way to the pilot, but in freight service they use a wrought draw head that will couple to a freight car without the use of a long bar.

Colored men are employed for laborers.

Mr. C. F. Thomas, who has been in charge here for some time, has, since my visit, taken charge of the Macon shops of the Central of Georgia. The engineers seem well contented here, have no classifications, get paid for delays, have good engines to run, and one and all spoke regretfully of Mr. Thomas' leaving, and expressed the hope that the next man would be as good.

AT MACON

Here is a little roundhouse and shop under the immediate charge of General Foreman Tracy, but the principal repairs are done at Atlanta.

SOME TIME-CARD COMPLICATIONS

On some of the divisions of this road, where branch trains run for some distance over the main line, the time-card is very confusing to a stranger, as there are odd and even numbered trains running in the same direction, being distinguished by the numbers alone, but the boys are used to it, and steer right along in safety.

J. A. H.

The Armagh disaster on the Irish Great Northern Railway, last year, has already cost that corporation £65,688 for damages alone, and they are not done settling yet by a good way. The wreck will cost close to half a million dollars.

Simple Lessons in Drawing for the Shop.

By Orville H. Reynolds.

SIXTH PAPER.

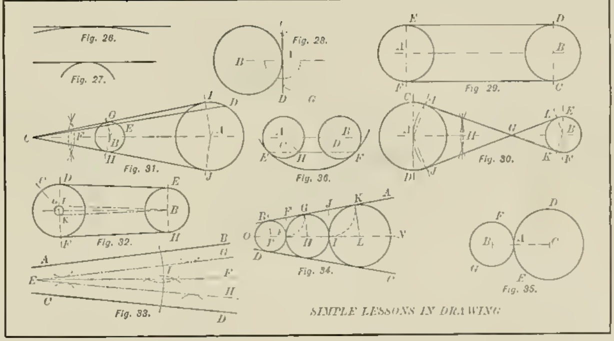
In pursuit of the light which is revealed to the earnest seeker, we are brought to a realization of the importance of geometry, for the exercises in previous paper were geometrical problems, although called by another name.

Let the interest once become awakened to the great truths laid before us by the geometrician, and it will be unflagging to the end.

The application of this science to the drawing board is absolutely necessary to success, for the reason that the whole fabric of mechanical drawing rests on the principles of geometry.

To continue: Figs. 26 and 27 are intended to show how difficult it is to draw a straight line to a circle, and touch the same in the right place, or what is known as making a true tangent. One of the arcs is of great radius, the other of lesser, and, without a definite point to draw to, the tangent is frequently drawn either within or without the circle, now, when it is remembered that a true tangent is perpendicular to the radius drawn from the point of tangency, and that point is on the circumference, the force of the foregoing is appreciated.

Fig. 28 shows how to draw a tangent to a circle from a given point in the circumference. Through the given point *A*, draw radial line *A B*, then the perpendicular *C D* to that line will be the required tangent. To find the perpendicular line, describe a semi-circle on line *A B*, and from its intersection with *A B*, describe four arcs as *C D*, then the line drawn through intersection of arcs at *C D* will touch circumference at *A*, giving true tangent.



SIMPLE LESSONS IN DRAWING

Fig. 29 represents two pulleys connected by an open belt, *i. e.*, one not crossed, if, now, there was no slack whatever in the belt, the pulleys would be connected by straight lines, and it is plain that the belt would furnish a good example of tangents. To construct Fig. 29, draw center line *A B*, and describe two circles of same size any distance apart, draw diameters *C D* and *E F* perpendicular to the center line, and the points where these diameters cut the circles are the points of tangency of the belt, joining the points by straight lines, we have true tangents.

Fig. 30 is an example of tangents drawn to two circles of unequal diameters, and is clearly represented by two pulleys which are driven by a crossed belt. To produce this figure, draw center line *A B* and describe given circles, perpendicular to the center line draw diameters cutting the circles at *C D* and *E F*. Draw *C F*, which will cross the center line at *G*; with the dividers bisect *A G* at *H*, now with radius *H A* and from *H* as a center, describe an arc on large circle at *I* and *J*, draw *A I* and *A J* from the center through arcs. In the small circle draw *B K* parallel to *A I*, and *B L* parallel to *A J*; draw straight lines from *I* to *K*, and from *J* to *L*; both lines will pass through *G*, and will be the required tangents.

Fig. 31 shows tangents drawn to two circles of unequal diameters; this construction can also be exemplified by two pulleys, and the tangents be supposed to represent an open belt.

Draw the center line *A B C*, on which describe given circles *A* and *B*. From centers *A* and *B* draw parallel radii *A D* and *B E*, from *D* to *E* draw a line, and produce it to meet the center line at *C*. Bisect line *C B* at *F*, and from *F*, with radius *F B*, describe an arc cutting small circle *G B H*. Draw the radii *B G* and *B H*, and from *A* draw *A I* and *A J*, parallel to *B G* and *B H*;

lines then drawn from C, through G and H, will meet the large circle at I and J, and tangents will touch both circles as required.

The above is also a method of drawing tangents to a circle from a point without it. The point C being the point without the circle; $C\ G$ and $C\ H$ being the tangents for circle B.

Another method of drawing tangents to circles of unequal diameters is shown in Fig. 32.

Draw the center line $A\ B$, describe the given circles, and draw in the larger circle A, radius $A\ C$, on which lay off $C\ G$, equal to radius of small circle B; from center of circle A describe a circle with the radius $A\ G$. Draw tangents $B\ I$, and $B\ K$ from center B. From A and B draw perpendiculars to these tangents, cutting circles at $D\ F$ and $E\ H$, draw straight lines from D to E, and from F to H, the lines will be the tangents sought.

How to bisect an angle when the vertex is inaccessible, is shown in Fig. 33. Draw the inclined lines $A\ B$ and $C\ D$; draw arcs near each end and between both lines; draw from E to G, and from E to H, lines tangent to the arcs; from E as a center, and with any radius, describe an arc as at I. Bisect this arc, and draw through it from E, producing the line to F when line so found will be center line of angle whose vertex is not shown.

Fig. 34 represents a number of circles between two inclined lines, circles at once touching the lines and each other. Find the center between the two inclined lines $A\ B$ and $C\ D$, by the method shown in Fig. 33, producing center line $N\ O$; from the point P, on this line, draw $P\ B$ perpendicular to the line $A\ B$; and from P describe the circle $B\ D$, touching the given lines, and cutting the center line at $O\ E$. From E draw $E\ F$, perpendicular to the center line $N\ O$, cutting line $A\ B$ at F; from F describe an arc, with a radius $F\ E$, cutting $A\ B$ at G, draw $G\ H$ parallel to $B\ P$, which is also perpendicular to $A\ B$. Take the center of the second circle at H, and describe it with the radius $H\ E$ or $H\ G$, touching circle $B\ D$ at E. From $I\ J$ draw perpendicular to center line $N\ O$, cutting $A\ B$ at J; from J describe an arc, with a radius $J\ I$, cutting $A\ B$ at K; draw $K\ L$ parallel to $G\ H$, or perpendicular to $A\ B$, and at intersection of $K\ L$, with center line $N\ O$, will be the center of the third circle, which, being described with the radius $L\ I$ or $L\ K$, will touch both inclined lines, also the second circle. This construction can be reversed, the larger circles described first and smaller ones after, making interesting practice.

In Fig. 35 we have the problem of describing a circle from a given point, so that it shall touch another given circle. If now $D\ E$ is the given circle, and B the given point, draw a line from B to the center C, and produce it to cut the circle at A. From B as a center, with a radius $B\ A$, describe the circle $F\ G$, which will touch the circle $D\ E$, as required. It is plain that it makes no difference whether the point B is within or without the given circle.

Fig. 36 is an arc touching two given circles. This construction is as follows: Connect the centers of the circles $A\ B$ by a straight line from C to D; draw a line from F, passing through D, indefinitely; at C draw $C\ H$, parallel to $D\ F$; draw $F\ H$ parallel to $C\ D$, and produce it to E; draw $E\ C$ and produce it to its intersection with line drawn from F to G; then from G, with a radius $G\ F$ or $G\ H$, describe an arc, touching both circles.

In these studies of straight lines tangent to circles and circular arcs, and of circles tangent to each other, no proof has been attempted, neither has the principle involved been explained; it being deemed unnecessary in these papers, for the reason that they are likely to cover more ground than was originally intended.

The acceptance of these and other problems as correct will save both time and space.

Railroad men have been noted for the fancy names given to their fast trains, hence we have "The Cannon Ball," "The Gee Whiz," "The Thunderbolt," "The Eli," and many others, but it remained for the trainmen of the Chicago Division of the "Santa Fe Route" to give a name to the new fast freight run that is both complimentary and expressive. They have dubbed it "The Nellie Bly."

The Fastest Time between Philadelphia and New York.

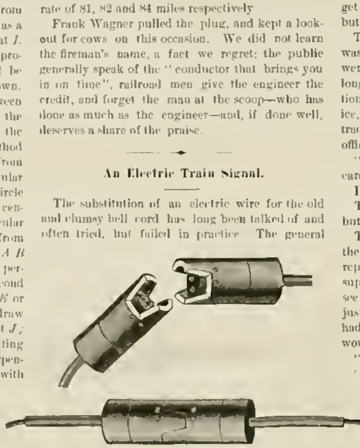
Early this month the Philadelphia & Reading ran a special from Philadelphia to New York, a distance of 89.4 miles, in the remarkable time of 85 minutes. The engine, the 366, a Wootten boiler, 18x24, 8 wheeler, was not prepared for the run, but taken out of the house hurriedly for the emergency.

The first revolution of the drivers was made at 11.38 A. M., and the real running began at Wayne Junction, on the outskirts of Philadelphia, which station was passed at 11.44½. From this point the road is peculiarly adapted to the attainment of high speed, being straight, free from heavy grades, and in excellent condition of maintenance. The fifty-four and nine-tenths miles between Wayne Junction and Bound Brook was covered in 49¼ minutes, an average speed of 66¾ miles per hour. The highest rate of speed reached was 87 miles per hour, and stretches several miles long were run at the rate of 81, 82 and 84 miles respectively.

Frank Wagner pulled the plug, and kept a lookout for cows on this occasion. We did not learn the fireman's name, a fact we regret; the public generally speak of the "conductor that brings you in on time", railroad men give the engineer the credit, and forget the man at the scoop—who has done as much as the engineer—and, if done well, deserves a share of the praise.

An Electric Train Signal.

The substitution of an electric wire for the old and clumsy bell cord has long been talked of and often tried, but failed in practice. The general



ELECTRIC TRAIN SIGNAL.

cause was that the connections between cars and in the buttons were too open, and gathered moisture that completed the circuit, and operated the signal when it was not intended to operate, thereby becoming a danger instead of a safeguard.

The Johnston signal has now been in successful operation for a couple of years and has proven a success.

The batteries are carried on the engine or a car, and on passenger cars the cable takes the place of the bell rope, having buttons every few feet in its length, as well as on the platforms; pushing a button rings the bell in the engine.

On freight cars the wire can be fastened anywhere, on top, under the eaves or under the car.

The connections between cars are covered with a strong hose and the heads are water-tight. Should the train part, this signal not only rings the signal bell in the cab, but one in the caboose or other cars as well, so that all the trainmen are notified of a break-in-two, an advantage over the rope and the air signal that any railroad man will recognize.

The cheapness of equipping trains with this signal ought to place it on freight trains forthwith, as there is now no reliable way for the conductor and engineer to communicate quickly.

A man named Archer has recently patented a snow-plow that just melts the snow by a gas flame in front, and thinks it will solve the snow blockade problem. There is no use in half doing a thing. Mr. Archer ought to put on an attachment that would run the melted snow into moulds, and let it freeze in the right shape for market.

A large union meeting of locomotive enginemen will be held at Elmira, N. Y., on the 6th.

"The Prince and the Pauper."

One of the supply men in the oil line tells a pretty good story on the purchasing agent of one of our trunk lines. This purchasing agent is one of the autocratic kind that sit behind three rows of sentinels, the first of whom demands to know what you want to see "Him" about, and the next asks for your card; you then wait twenty-four minutes, when the third emissary appears and informs you that "He" is too busy to see any one, but will be glad to see you at 11:15 day after to-morrow.

Well, our oily friend had received a bluff or two of that kind from the Prince, and had given up trying to see him on business, although the main office of the oil company was located in the same city as the headquarters of the road, whose supplies were bought by the Prince.

This road used tallow for cylinder oil, and through some miscalculation of the Prince, the supply ran short—then out, they tried all about to get tallow to piece out till an order could be filled, but it was no go—there was not a barrel in sight.

This news came to the ears of the oil man, who was then in charge of the main office. There were 10 or 15 barrels of tallow in an odd corner, long reserved for an emergency in their "combination" business; here was a chance to break the ice, do the Prince a favor, and enter the wedge of trade; he put on his coat and went to the railroad offices.

"Could he see Prince So-and-So?" If he had a card the slave would see.

He had a card.

The Prince could not possibly see anybody then, but would probably be at leisure next week.

The Pauper started home; in the yard he met the M. M., and mentioned the fact that he had been repelled by the halo of the Prince — said he supposed that a purchasing agent's place was to see everybody—but still, it was nothing to him, he just heard they were short of tallow, and, as they had a few barrels they could spare, thought they would offer it in a neighborly way, to help out.

"Have you got any tallow?" exclaimed the M. M.

"Ten or fifteen barrels for our own use, that's all."

The M. M. made a bee-line for the general office.

The supply Pauper went home, locked the door, and posted his office boy.

In ten minutes the telephone bell rang.

"Hello!"

"Hello, yourself!" said the boy.

"This is the Purchasing Prince of the Thus & Such Ry. Is Mr. Supply Pauper there?"

"Yep."

"Tell him to step to the 'phone, please."

"Can't, he's too busy."

"But it's important business."

"Everything is important with *us*."

"Tell him it is Mr. Prince."

"Dassent disturb him, you can't get him by telephone."

Thirty minutes later the Prince bounced into the outer office of the Pauper.

"Mr. Pauper in?"

"Yes, sir."

"I wan'ter see him."

"Card, please; take a seat."

After ten minutes the boy returned. "Mr. Pauper is too busy to see any one this week, but says if you'll come in next Thursday at 3 P. M. he can see you."

"But this is a matter of importance."

"Can't help it; I must not disturb him again to-day."

The Prince bolted out, and as he passed along the hall it was noticed that the halo was dim.

He got that tallow by sending a letter by special delivery, in which the role of Prince and Pauper were reversed.

The Prince still rattles around in a cavern of exclusiveness several sizes too big for him, but men on the road say that when that particular oil man throws in his card the Prince thaws out at once, and will always see him on days when his own wife has no show at all.

The Master Mechanics' Association will not meet in Chattanooga this year, on account of lack of hotel accommodations. New place not yet decided upon.

Bert Hilliard, of Ottowa, Ill., Persey Warner, of Salisbury, Conn., and Jere N. Hall, of Raleigh, N. C., write to say that they are younger than Mr. Wm. Davis, and thus entitled to the youngest subscriber prize.

On the East Tennessee road they bush cylinders that are worn too large; slightly broken cylinders are easiest repaired by boring them out, and putting in heavy bushes

The last sentence in the Georgia Central agreement, on page 62, sounds rather odd—the company agreeing to discharge itself if it violates the agreement.

In making out accident reports, tell the whole truth—let the officers draw the inferences and supply the falsehoods.

If you have sent us questions do not be surprised to find them missing in the next issue—they have to take their turn.

The New England Railroad Club recently discussed the M. C. B. vertical plane coupler—and condemned it.

Whatever your position, try to be the best man on the road in that position.

Is there a library on your road? If there is, do you patronize it?

PATENT OIL CUPS.

These Oil Cups do not require a handful of tools to regulate. The cuts give a good idea of their appearance and construction. The spindle is easily manipulated and remains in any desired position, no extra tools are needed for adjustment, and there is plenty of room to easily clean them out. They are in extensive use by the Northern Pacific, Southern Pacific and Phila. & Reading R. R. Cos., and are pronounced superior to any other Cups ever used.

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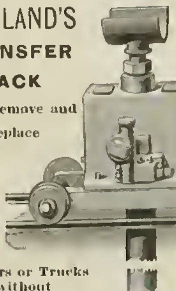

Drivers or Trucks without Jacking Up.

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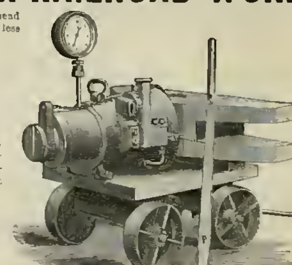
IN USE ON 10 RAILROADS.

Hydraulic Press for forcing pins into Locomotive Drivers, either under the engine or out. Also useful about Railroad Shops, for forcing on and off Balance Wheels, Cranks, Gears, Pulleys, etc Inclosed Piston. Cannot Clog. Valves are large and fall to their seats, no rush of water being required to seat them Parts easily examined or repaired. Pump is independent of cylinder casting Movement of ram, 12 inches. 60 to 150 tons pressure.



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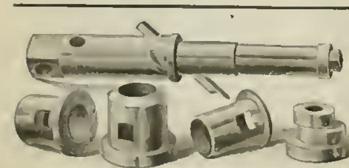

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THE LOCOMOTIVE ENGINEER.

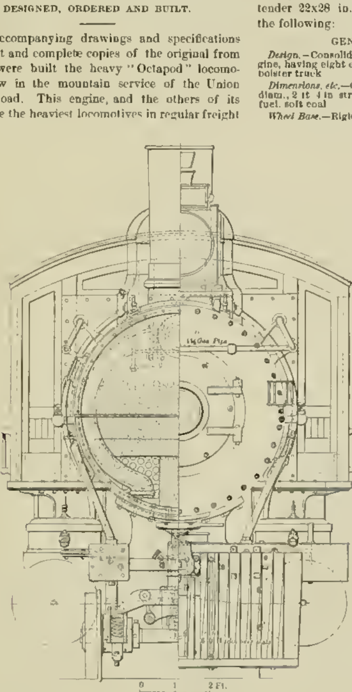
DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 5. NEW YORK, MAY, 1890. $1.00 per Year or 10c. a copy.

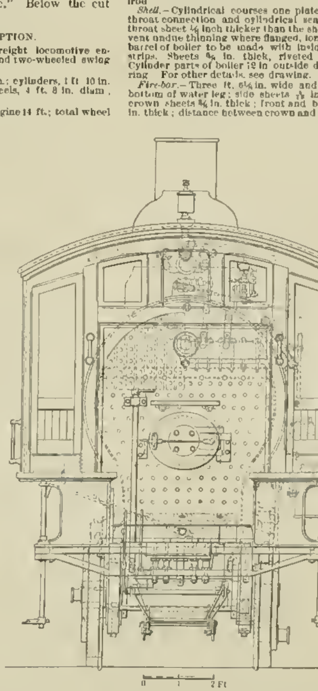
A Modern Freight Locomotive.

COMPLETE DRAWINGS AND SPECIFICATIONS, IN DETAIL, SHOWING HOW A LOCOMOTIVE IS DESIGNED, ORDERED AND BUILT.

The accompanying drawings and specifications are exact and complete copies of the original from which were built the heavy "Octapod" locomotives now in the mountain service of the Union Pacific road. This engine, and the others of its class, are the heaviest locomotives in regular freight service. The monster 12-wheeled locomotives of the Central Pacific weigh but 123,000 pounds, the big "Octapods" on the Northern Pacific 150,000, and this 153,000 pounds. The "Decapods" are 12-wheeled and weigh 150,000, but there are but a few of them in the world, and are used as pushers. The original drawings of this locomotive were some five feet in length, and had all the sizes and distances apart of all centers marked on; in reducing them to the requirements of the paper, these sizes had to be left off in order to show the design clearly, but a scale has been substituted so that any piece can be measured



HALF FRONT, SECTION. HALF FRONT VIEW



REAR VIEW

The first page of the specifications had an outline sketch with principal sizes given, as shown on page 83, above which was printed .

"Specification 114 for a broad gauge engine and tender 22x28 in. Union Pacific." Below the cut the following:

GENERAL DESCRIPTION.

Design.—Consolidation pattern freight locomotive engine, having eight coupled wheels and two-wheeled swing bolster truck

Dimensions, etc.—Gauge, 4 ft. 8½ in.; cylinders, 1 ft 10 in. diam., 2 ft 4 in stroke; driving wheels, 4 ft. 8 in. diam , fuel, soft coal

Wheel Base.—Rigid wheel base, engine 14 ft.; total wheel base, engine 22 ft. 8 in.; total wheel base engine and tender 49 ft ¼ in ; length of engine and tender over all, 62 ft. 7¾ in.

Weight – Weight on drivers, two gauges water, about 138,000 pounds ; weight of engine, two gauges water, about 153,000 pounds.

Heating Surface —Heating surface of fire-box, 178.00 sq. ft.

Surface —Heating surface of tubes, 2,114.00 sq. ft.: total heating surface, 2,292.00 sq. ft ; area of tube openings 831 sq. in.: heating surface per square inch of cylinder area, 3.05 sq. ft ; square inch cylinder area to square inch tube opening, .912 sq. in.; steam pressure, 160 pounds".

DRAWINGS.

For list of drawings referred to in these specifications, see pages 13 and 14 of specifications Drawings and such interlineations, notes figures and details as may be upon them are to be considered as a part of and illustrating these specifications

BOILER.

Kind.—Boiler to be made of form known as Wagon Top, with dome 1 ft. 10 in high, and 2 ft. 8½ in. diameter placed on same

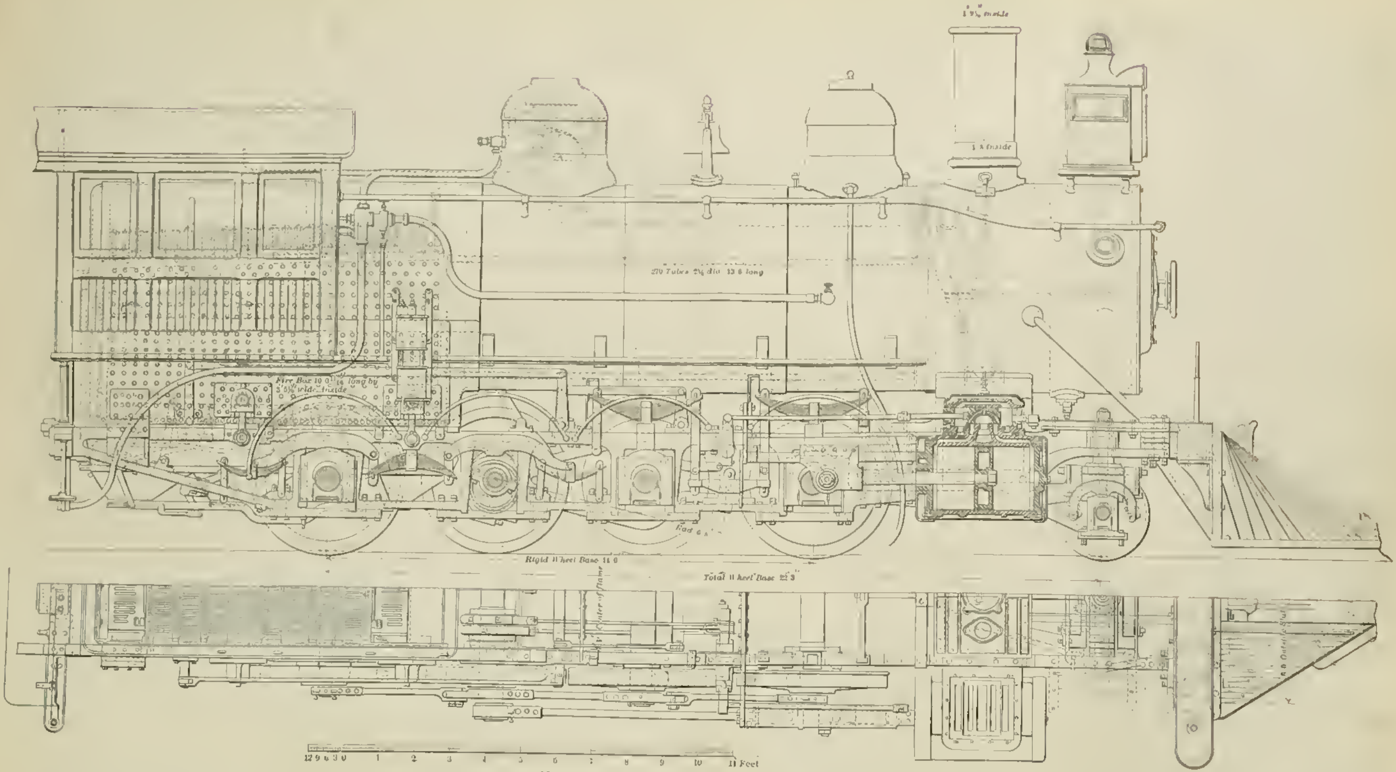
Material.—Shell, fire-box and flue sheets of steel ; brand of steel as shall be elected. Stay bolts and braces, Sligo iron

Shell.—Cylindrical courses one plate each ; horizontal, throat connection and cylindrical seams double-riveted, throat sheet ⅛ inch thicker than the shell of boiler, to prevent undue thinning where flanged, longitudinal seams on barrel of boiler to be made with inside and outside welt strips. Sheets ⅝ in. thick, riveted with 1 in. rivets. Cylinder parts of boiler 62 in outside diameter at smallest ring For other details, see drawing.

Fire-box.—Three ft. 6¼ in. wide and 10 ft. 11/16 in long at bottom of water leg ; side sheets 5/16 in. thick ; back and crown sheets ⅜ in. thick ; front and back tube sheets, ½ in. thick ; distance between crown and top sheets 1 ft. 11⅝ in. front, 2 ft. 2⅝ in. back ; water space, back and sides, 3½ in., front, 4 in. Stay bolts of Sligo stay bolt iron 1 in. diameter, placed not over 4¼ in center to center, screwed and riveted over sheets at both ends ; after being riveted over, each stay bolt to have hole drilled in outer end 3/16 in diameter by 1 in. deep

Crown Bars —Crown sheet supported by 27 crown bars, each made of two bars of iron ¾ by 7 in., welded at both ends ; ends to have a firm bearing on side sheets ; distance, center to center, about 4⅛ in.; crown bar bolts to be screwed in from inside of fire-box ; cap, washer and nut on top of crown bar The ¾ by ¾ in square part " C. C." only to screw crown bar bolts in by. Put three thimbles only as B. B B., between each crown bar and crown sheet thimbles 2 in long, located as shown

Tubes —National Tube Works " Franklinite Tubes" with copper ferrules on both ends, rolled at front end and swedged, rolled and beaded at fire-box end, 270 in number, 2¼ in. outside diameter, No. 11 B W. G. in thickness and 13 ft. 6 in. in length. Material for tubes to be iron, tough and of even grain, and as specified below



MODERN FREIGHT LOCOMOTIVE. PLAN AND SECTION.

PHYSICAL TESTS, MATERIAL, &c

Stay Bolts.—Stay bolts and braces to be Sligo iron, and to have a tensile strength of 50,000 pounds, and an elongation of not less than 28 per cent in a test section originally 4in long, the diameter of specimen in no case to be more than ¼ the original length

Boiler Steel.—All steel used in construction of fire-box and shell must conform to the following requirements A test strip 24 in. long by 1½ in wide, taken from any sheet, must have, without annealing, a tensile strength of not less than 50,000 pounds per square inch, nor more than 65 000 pounds per square inch, with an elongation of not less than 28 per cent on a length of 4 inches. Reduction of area at point of fracture to be not less than 50 per cent. of original area. Boiler to be strongly made, and braced at all parts All plates to be planed at edges and calked with round-pointed tool. Boiler to be of best workmanship and best material of its kind throughout

Tubes.—Tubes to be lap welded and of uniform thickness and quality. Each tube must flange when hot without crack or sign of distress; must expand and bend over when cold without sign of cracking or fatigue, and by immersion in diluted acid show a perfect weld Under these tests the iron must show a clear grain, free from sand and cinder. A specimen 1½ in. long, cut from tube taken at random, must stand hammering vertically, and show but slight splitting when crushed down solid. They must also when tested show a tensile strength of not less than 55,000 pounds per square inch, and a ductility of 15 per cent To be subjected to an internal hydraulic pressure of not less than 300 pounds before insertion

Test.—Boiler to be fired up before lagging is put on and tested as perfectly tight under a hot water pressure of 200 pounds per square inch, and to be capable of carrying with safety a working pressure of 160 pounds per square inch

Cleaning.—Cleaning holes and blow-off cocks located as per drawings

Throttle and Steam Pipes.—To have balance valve placed in dome, wrought-iron dry pipe, etc

Grates.—Union Pacific Shaking Grate "7—D" of finger pattern as shown, of cast-iron, with one drop grate in front and one at rear end of box

Ash pan.—Hopper pattern, body of pan of $\frac{3}{16}$ in. sheet-iron, hopper frames and doors of cast iron.

Smoke Box and Stack.—Extension front end and straight stack. Smoke-box proper of $\frac{1}{2}$-inch steel, 6 ft. 1 in outside diameter Extension of $\frac{5}{8}$-inch steel, 6 ft 1 in. outside diameter by 2 ft. 9 in long, to be furnished with hand hole, cinder hopper, etc Stack of iron or Bessemer steel $\frac{3}{16}$ in thick

FRAMES

Of best charcoal hammered iron, with pedestals welded on Top bar 4 in wide and $5\frac{1}{2}$ in deep Front rails 4 in wide, bolted and keyed to main frames, and with front and back lugs forged on for cylinder connections Distance over frames, 4 ft 2 in All holes to be marked from one template, and drilled and reamed out to exact sizes given.

Pedestals.—Pedestals protected from wear of boxes by cast iron gibs and wedges Pedestal tie bars securely lugged and bolted to bottom of pedestals.

MACHINERY.

Cylinders.—To be made of the best close grained hard and strong cold blast cast-iron, free from honeycomb or other defects; cylinders to be set horizontally as shown on drawings, each cylinder cast in one piece with half saddle right and left, cylinders reversible and interchangeable, accurately planed, fitted and bolted together in the most approved manner All bolt holes to be reamed and turned bolts a driving fit, valve seat and steam chest seat raised above face of cylinder to allow for wear

Diameter, 1 ft 10 in; stroke, 2 ft. 4 in, distance, center to center, 7 ft $1\frac{1}{8}$ in; length of ports, 1 ft 4 in., width of steam ports, $1\frac{3}{4}$ in; width of exhaust port, $3\frac{1}{4}$ in

Pistons and Rods.—Solid heads of cast-iron with cast-iron snap rings 1 in wide by $\frac{5}{8}$ in. thick Piston rods of best hammered charcoal iron, 4 in diameter by 4 ft $4\frac{11}{16}$ in. long out to out, to be ground and keyed to crossheads, and ground, riveted and nutted to pistons.

Rod Packing.—Piston rods and valve stems fitted with the "Jerome patent metallic packing."

Guide Yoke.—Extending across frames, made of best quality of hammered iron.

Guides.—Two guide bars for each cross-head, made of steel Top guide $2\frac{3}{4}$ in. by 7 in., bottom guide $3\frac{1}{2}$ in. by $4\frac{3}{4}$ in., fastened as shown

Crossheads.—Made of best cast-steel, "Lairds" pattern, with babbitted bearings

Valve Motion.—Most approved shifting link motion, graduated to cut off at all points of stroke; links of Lowmoor iron, case-hardened; sliding blocks, pins, bushings, lifting links and eccentric rod jaws, of best refined hammered iron, well case hardened; sliding blocks with long flanges to give increased wearing surface, rocker shaft of refined iron, and made without weld; journal, 4 in diameter by 1 ft. $2\frac{1}{8}$ in. long, with arms $1\frac{5}{8}$ in thick Reverse shaft of refined iron

Main Valves.—Engine to be equipped with Richardson-Allen balance valves

Eccentric and Straps.—Eccentric must be made to fit true on driving axle, and to be fastened on same as shown; outer rim of same to take strap must be turned off smooth and true, and eccentric straps must be fitted up to go on same a fine, true working fit Eccentric straps and blades must be fitted up so blades will be true to same, and be so set.

Blades.—In forging blades they must not be butted to stub end or foot by which they are bolted to strap, but stub end, and not less than 8 to 12 inches of blade must be forged solid. After work is put on same the blades will then be welded up with most approved form of lap weld.

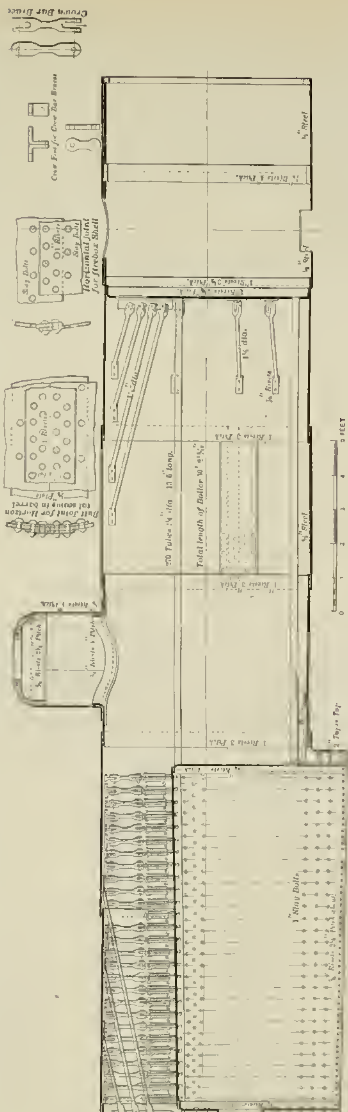
Driving Wheels.—Number of pairs of driving wheels, 4; diameter of driving wheels 4 ft. 3 in.; diameter of driving wheel centers, 3 ft 8 in; thickness of tires, finished, $3\frac{1}{2}$ in; width of first and fourth pair of tires, $5\frac{1}{2}$ in. flanged; width of second and third pair of tires, 6 in. plain Tires of Krupp crucible steel; centers of cast-iron, with solid hubs and spokes, and hollow rims. Driving wheels must be forced on axles a smooth parallel fit, with a pressure of not less than 70 tons nor more than 80

Driving Axles.—Made of best hammered iron Journals $8\frac{1}{2}$ in diameter and 9 in. long, wheel fit, $8\frac{3}{4}$ in diameter.

Driving Boxes.—Of cast-iron, with round solid brasses, babbitted; cast-iron cellars, shoes and wedges; style and size as shown

Driving Springs.—Union Pacific No 67, 16 leaves, $\frac{3}{8}$ by $3\frac{1}{2}$ in. by 3 ft, 3 in. over all, U P. No 68, 15 leaves, $\frac{3}{8}$ by 4 in by 2 ft 7 in. over all; U. P No 69, six leaves $\frac{5}{8}$ by $3\frac{1}{4}$ by 2 ft $\frac{1}{4}$ in. Springs to be of approved manufacture.

Rods.—Main and parallel rod of best quality of charcoal hammered iron, forged solid; main rod fitted with necessary straps, keys, bolts and brasses, side rods fitted with necessary keys, bolts, brasses and bushings, etc., all as per drawings Brasses of best ingot copper and tin alloyed in proportion of 7 parts copper and one tin.


LONGITUDINAL SECTION.

Crank-pins.—Of best quality charcoal hammered iron. Wheel fit, main pins, $6\frac{1}{2}$ in diameter, first, second and fourth, 5 in diameter For other details see drawing Pins must be turned a smooth parallel fit, and be forced to place with a pressure of not less than 30 nor more than 40 tons

Equalizing Beams.—Of best charcoal hammered iron.

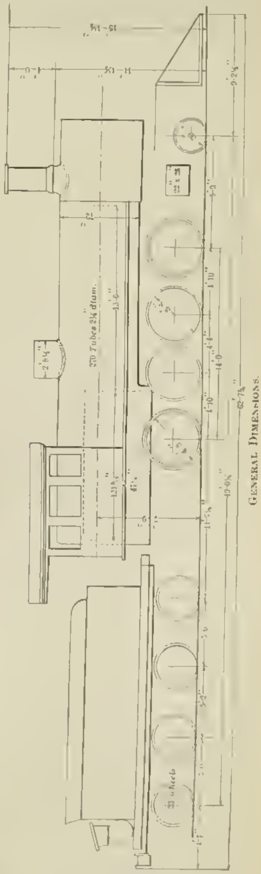
Feed Water.—Supplied by two No 10 Monitor lifting injectors arranged with cocks and valves for convenience in working

ENGINE TRUCK

Plan.—Center bearing swiveling, two wheel truck with swinging bolster and radius bar, wrought-iron frame and pedestals.

Wheels.—Cast-iron, 30 in diameter, to be pressed on axle a smooth parallel fit, with a pressure of not less than 35 tons nor more than 45 tons Wheels must be located on axles so as to give a total lateral motion of $\frac{3}{4}$ in. between wheel flanges and rail; see gauge Wheels must conform to U. P. Wheel Specification No 765

Axles.—Union Pacific No 24 of best hammered iron 5 ft $7\frac{1}{2}$ in long, with inside journals 5 in diameter by $10\frac{1}{4}$ in long


GENERAL DIMENSIONS.

Springs.—Union Pacific No 121, double coil, spring to be of approved manufacture.

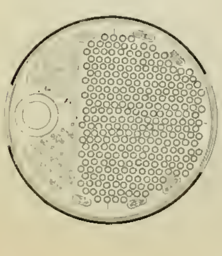
ACCESSORIES

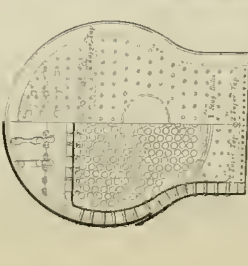
Cab.—To be substantially built of ash, and fastened together by joint bolts and corner plates, and securely braced to boiler and running board. Width of cab, 9 ft 8 in. For other details see drawing

Pilot.—Union Pacific pilot "D," to be built of oak and iron, provided with cast-iron push bar casting and wrought iron push bar

Finish.—Cylinders lagged with wood and neatly cased with sheet-iron, painted, cylinder head covers of cast iron, turned and painted Steam chests with cast iron tops, bodies cased with sheet-iron, painted Dome to be lagged, sheet iron casing, top and bottom rings of cast-iron, to be painted; hand rails of iron, running-board nosing of 2 by 2-inch angle iron. Boiler lagged with wood, neatly jacketed with American planished iron, secured by iron bands of same material

Furniture.—Engine to be provided with sand-box, support for headlight, headlight, bell, $5\frac{7}{8}$ inch steam whistle, U. P. pattern; steam gauge, gauge cocks, cab lamp, blower, engineer's and fireman's seat boxes and cushions, gong in cab, wheel covers, etc.; and it must be clearly understood engine is to be furnished with all modern improvements and appliances necessary to the com-


FRONT TUBE SHEET.


FIRE BOX. BACK END.

pletion and equipment of a first-class locomotive engine and tender, though mention thereof may have been omitted in specifications and drawings

Headlight.—Union Pacific standard headlight "B," with Williams' patent safety headlight burner, No 1 pattern To be furnished with illuminated numbers, frames for same, etc, all as per specification and drawings to be furnished.

Flags and Flag staff—Engine to be furnished with metal flags and flag staffs, two green flags, two white flags, made of 18 B. W. G sheet-iron or steel. Staff of cast-iron and 1/2 inch gas pipe.

Steam Gauge—Two Crosby steam gauges, one placed in convenient position for engineer in cab, and one at back of fire-box for fireman. Dial, 6 3/4 in. diameter, with brass or other equally good case. graduated not over five-pound marks up to 200 pounds per square inch.

Safety Valves.—Three 2 1/2-inch Ashton locomotive pop safety valves, one of same to be fitted with lifting lever attachment, to be arranged in dome cover as shown.

Cylinder Lubricators, etc—Main valves and cylinders to be oiled from the cab by Nathan Mfg Co.'s No 9 locomotive sight-feed lubricators, placed in cab and connected to steam chest by copper pipes running under jacket, pipes proved to 300 pounds pressure. Vacuum valves in cylinder. Connecting rods and guides fitted with the Pedrick & Ayer oil-cups, size, etc, as per drawing. Lubrication of all bearings to be carefully provided for, and oil-cups attached where required. Also to be furnished with U P. hand cylinder oil cups arranged in conjunction with the automatic cup

Brakes—To be equipped with 8-inch air pump as per plate B 7 Westinghouse catalogue 1886 Automatic brake applied to tender Air pump to be oiled from the cab by Nathan Manufacturing Co's locomotive sight-feed lubricators Driver brakes as shall be elected To be fitted with the Ross Meehan shoes, also LeChatelier back-pressure brake appliance. Main reservoir located at rear of tank, and to be 2 ft diameter by 6 ft 4 1/2 in long inside

List of Tools—Two heavy jack screws and levers, one pony jack two frogs, one tie line, one switch chain, one heavy pinch bar with steel point and heel, one plugging bar, one grate shaking lever one poker, one slash bar, two coal picks, one ash hoe, two scoop shovels one steel buggy bar, one axe, one saw, three cold chisels, two flat and one cape, one hard hammer, one copper hammer, two monkey wrenches, one each 12 and 15 inches, a complete set of wrenches for all nuts and bolts on engine, one set of driving-box packing tools, one packing iron, one packing hook, one broom, one tin box for torpedoes, two flagstaffs U P standard, one water bucket, one tallow bucket, one gallon oil can, two half gallon oil cans, two engine oilers, one cylinder oil-can

Extra Supplies and Material—Two short draw bars, one long round coupling pin, one long flat coupling pin, two tender brasses, six flue plugs one hose feed pipe, one pair of air-brake hose and couplings two headlight chimneys

PAINTING.

Location of lettering, numbers etc, to be as shown by drawing For color, manner of mixing paints, etc see special specification attached

TENDER.

Tank Tank to be strongly put together with angle iron corners, and well braced, top and bottom sheets of No 6 iron, inside and outside sheets of No 8 iron Capacity, 2,900 gallons

Frame To be substantially built of first quality oak, well seasoned and free from all defects, to conform to drawing.

Truck—Union Pacific standard tender truck "O," rigid center bearing truck with wrought-iron, square corner frame and equalizers Pedestals cast-iron, rear truck only to have side bearings.

Safety Chains Each truck to be furnished with four 3/4 in safety chains, attached by clevis and pin to truck frame and to hook on tender frame For location of hooks on tender frame, see drawing

Springs. Union Pacific No. 54 thirteen leaves, 3/8 by 3 1/2 in. by 3 ft 3/4 in. long over all, to be of approved manufacture.

Journal Boxes—Of cast iron, to be cast square and smooth inside and outside, and to be free from lumps or other imperfections, seat for lid to be planed and lug drilled, and tapped 3/4 inch, nine threads

Journal Box Lids—To be the Fletcher swing lid of pressed steel, as made by the Morris Box Lid Company, to conform in size to drawing to be held in place by a 3/4 inch bolt screwed through lug on box and by nut and cotter

Dust Guards—Of white wood, 11/16 inch thick

Journal Bearings—Union Pacific No. 40, to be made of new metal composed of one part tin and eight parts of ingot copper, covered on bearing side about 3/16 inch thick with fine babbitt, made as follows

87.4 parts tin.
4.2 " copper
8.4 " antimony.

100

Bearing face of brass to be formed to radius of 2 3/4 in bearing face of babbitt to radius of 2 1/2 in A sample bearing to be furnished contractor by the railway company, and in no case will they be accepted unless up to standard in every respect as specified

Journal Bearing Keys—Of the Bissell pattern, to be made of wrought-iron, with stop plate of brass to be securely riveted to same Stop plate to be of same composition as journal bearings.

Packing.—Journal boxes must be packed with woolen waste only, one and one quarter pounds to each box and well oiled, safe to run without re-packing

Wheels—Cast-iron wheels, 34 in diameter, to be pressed on axles a smooth parallel fit with a pressure of not less than 35 nor more than 45 tons Wheels must be located on axles so as to give a total lateral motion of 3/8 inch between wheel flange and rails; see gauge. Wheels must conform to U. P. Wheel Specification 755.

Axles—Union Pacific axle No. 40, 7 ft 1/8 in. long, 4 1/2 in. diameter at center; journals, 4 1/4 by 8 1/2 in.; wheel fit, 5 in diameter. Axle to be stamped on each end "40," with about 1/2-inch figures; after stamping smooth off ends to remove all burr. Axles must be furnished subject to all conditions called for by specification A, No. 756, attached. The date when axles are put under tender must be stenciled on with black on a white ground.

Tool-Boxes—Three tool-boxes of hard wood, bound with iron and furnished with locks and keys, and to be placed on tender Tender to be provided with coal gate and shovel plate. See detail.

GENERAL FEATURES OF CONSTRUCTION

Gauges—All parts of engine and tender accurately fitted to gauges and templates, and to be thoroughly interchangeable

Case hardening.—All finished movable nuts to be made of iron, case-hardened

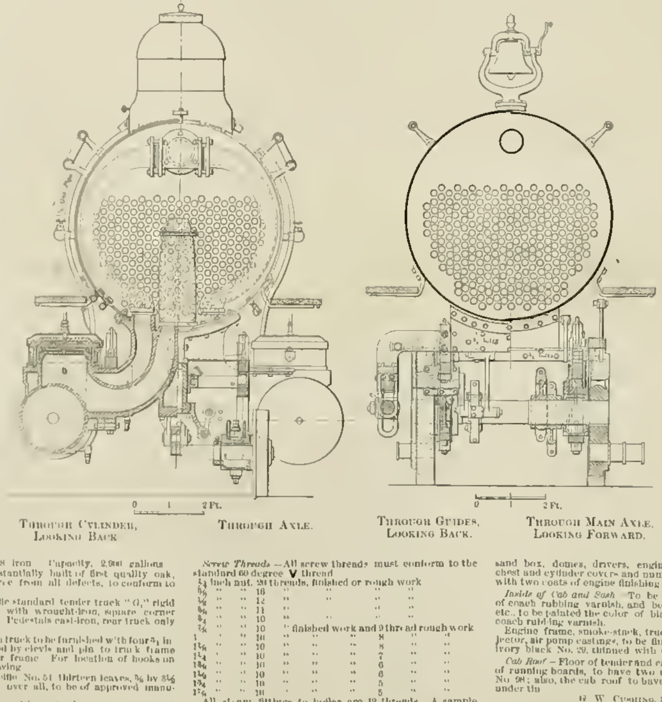
Brasses—All wearing brasses made of the best ingot copper and tin alloyed in proportion of seven parts copper to one of tin, unless otherwise specified.

Babbitt.—All babbitt used in construction of engine and tender must be of the following compositions:

87 4 parts tin.
4 2 " copper
8 4 " antimony

100

Forgings and Castings.—All forgings and castings must be first-class in every respect



THROUGH CYLINDER, LOOKING BACK

THROUGH AXLE.

THROUGH GUIDES, LOOKING BACK.

THROUGH MAIN AXLE, LOOKING FORWARD.

Screw Threads—All screw threads must conform to the standard 60 degree V thread

1/4 inch nut.	20 threads, finished or rough work		
5/16 " "	18 " " " "		
3/8 " "	12 " " " "		
5/8 " "	11 " " " "		
3/4 " "	10 " " " "		
7/8 " "	10 " finished work and	9 thread rough work	
1 " "	10 " " "	8 " "	
1 1/8 " "	10 " " "	8 " "	
1 1/4 " "	10 " " "	7 " "	
1 3/8 " "	10 " " "	6 " "	
1 1/2 " "	10 " " "	6 " "	
1 3/4 " "	10 " " "	5 " "	
1 7/8 " "	10 " " "	5 " "	

All steam fittings to boiler are 12 threads A sample nut and blank for each of the above, fitting Union Pacific standard taps and dies, will be furnished contractor All nuts used in the construction of engine and tender must conform to samples in outside dimensions as well as in diameter and form of thread

Pattern Numbers—Pattern numbers are given on drawings to be cast on all castings

CONDITIONS OF CONTRACT

All forgings, casting, boiler sheets, or other material used, must be first class in all respects. All wood and iron work, painting, etc, must be done in a first-class manner in all respects, and engine and tender must be fitted up in the most substantial and workmanlike manner, and be furnished with all the tools, trimmings and fixtures necessary to equip a first-class passenger locomotive engine and tender, though mention thereof may have been omitted in the specifications and drawings. Contractor must understand that by this is included all convenient trimmings and fixtures common to locomotive equipment, as well as the indispensable ones. Engine and tender must be turned over to this company all complete and ready for service. The whole to be subject to such tests and inspection as the superintendent of motive power and machinery, or his authorized agent, may require Any inferior material or any unfaithful or imperfect work discovered will be rejected The inspection of this work, however, will not relieve the contractor of any of his obligations to furnish material and workmanship as herein specified. Contractor to protect this company against all patent rights and claims.

G. W. CUSHING,
Sup't M P. and Machinery

Omaha, Neb., March, 1890.

PAINTING LOCOMOTIVE ENGINES AND TENDERS
SPECIFICATIONS NO. 768.
UNION PACIFIC RAILWAY COMPANY
OFFICE SUP'T MOTIVE POWER AND MACHINERY.
January, 1890

Priming.—Tank, sand box, steam domes, drivers, truck wheels, cylinder and steam chest covers, engine frame, smoke stack and all wrought-irons to be primed with a paint composed of 10 pounds English red lead standard color No. 77; 8 pounds Johnson's magnetic paint, standard color No 95; 1/4 pound Eddie's lamp-black, standard color No. 65; thinned with priming oil, composed of one gallon, best boiled linseed oil; one qt. turpentine; 1/2 pt. best Japan, and well rubbed out under the brush.

All wood-work, except inside of sash, to be primed with a paint composed of 4 pounds white lead, standard color No. 30; 2 pounds Prince's metallic, standard color No. 97; made quite thin with priming oil composed of 2 gals. raw linseed oil, 1 pt coach Japan, 1 qt turpentine, mixed.

Surfacing.—All nail holes, etc, to be filled with hard drying lead putty, and tank, drivers, all rough irons, and all wood except inside of cab, to be brought to a level surface with a paste filler composed of 5 pounds white lead, standard color No 30; 1 pound Prince's metallic, standard color No. 97; 4 pounds whiting, ground thick in coach Japan, and applied with a broad stiff knife, leaving none on the surface.

Second Coat—Tank, outside of cab, sand box, domes, drivers, engine truck wheels, cylinder and steam chest covers and pilot, to be second coated with a mixture of 5 pounds white lead, standard color No. 30; 5 pounds ivory black, standard color No 29; thinned with turpentine.

LETTERING.

Letters and Numbers for Freight Engines.—To have two coats of standard color No 8, as per pounce patterns furnished.

Letters and Numbers for Passenger Engines—All letters and numbers on cab, sand box, and front end to be in gold, standard colors No 30 and 32. Numbers on tank to be two coats of standard color No. 6.

Rods—To be finished the same as the drivers.

Sash.—To have double thick glass, outside of sash to have two coats of ground color, and grained light mahogany or bey wood Inside to be filled and finished on the natural wood.

Inside of Cab—To have two coats of green, standard color No 34, thinned with turpentine

Tender Frame.—To be coated inside before floor is laid, and all joints put together with mineral paint, standard color No 98

Inside of Tank, etc—Water space and coal space, top and bottom of tank, outside of boiler under the lagging, and inside of wrought-iron plates on tender frame, to have a good coat of color, composed of 10 pounds red lead, standard color No. 77; 10 pounds Johnson's magnetic paint, standard color No 95; thinned with boiled linseed oil, and thoroughly coated, especially the water space

Finishing—Tank, outside of cab, sash, sand box, domes, drivers, engine truck wheels, steam chest and cylinder covers and number plate, to be finished with two coats of engine finishing varnish.

Inside of Cab and Sash To be finished with two coats of coach rubbing varnish, and boiler plates, seat boxes, etc., to be painted the color of black walnut, mixed with coach rubbing varnish.

Engine frame, smoke-stack, trucks, all irons, chains, injector, air pump castings, to be finished with two coats of ivory black No. 29, thinned with engine finishing varnish.

Cab Roof—Floor of tender and cab, and top and bottom of running boards, to have two coats of standard color No 98; also, the cab roof to have one coat of the same under tin

G W CUSHING, Sup't M P. & Mach'y

UNION PACIFIC RAILWAY COMPANY,
OFFICE SUP'T MOTIVE POWER AND MACHINERY,
SPECIFICATION A—NO 756

FOR IRON AXLES

Iron axles must be forged under hammer to schedule sizes given in requisition, from iron double rolled from muck bar not more than 3/4 in. thick; the iron must be tough and fibrous, homogeneous and free from scrap

They will be ordered subject to the following conditions For every 100 axles or fraction thereof ordered, one additional to be furnished, from which one will be taken at random and subjected to the tests prescribed below:

To withstand without fracture three blows at 10 feet and two blows at 15 feet of a 1,640 pound hammer, striking axle midway between supports three feet apart; axle to be turned over after each blow. Tensile strength to be not less than 48,000 pounds per square inch, with an elastic limit of 26,000 pounds, and an elongation of not less than 18 per cent. on test pieces four diameters in length.

If the axle stands the prescribed test all the axles which it represents will be carefully inspected, and those only will be accepted which conform to size called for, and which are made and finished in a workmanlike manner.

If the axle does not stand the test, all the axles which it represents will be rejected.

All axles must also turn smooth and true, and be perfectly free from journal cracks, seams or other imperfections, otherwise they will not be accepted.

All axles must be cut square on ends, and to the exact length called for; to be accurately centered and drilled to conform to Union Pacific Center Gauge No 1 Gauge to be furnished axle maker from the office of Sup't Motive Power and Machinery.

Great care must be exercised to see that axles are cut off to exact length and centered to gauge

All axles must be stamped midway between ends with maker's name and place of manufacture, also metal of which they are made, which in this case would be "muck bar iron". the word "iron" alone is not considered sufficient. Letters which compose stamps to be not less than ½ in. long.

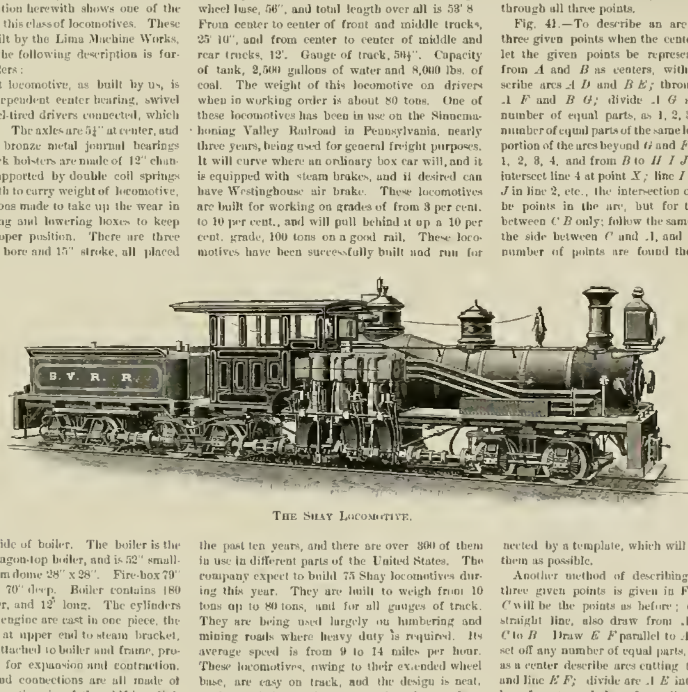
G. W CUSHING, Sup't M P. & Machinery

Omaha, Nebraska, December 24th, 1889.

The Shay Locomotive.

We have several times been asked to illustrate and describe the Shay locomotive, especially built to climb heavy grades, such as found in logging camps, some of which are upward of 500 feet per mile. The illustration herewith shows one of the latest and largest of this class of locomotives. These locomotives are built by the Lima Machine Works, of Lima, O., and the following description is furnished by the builders:

The Shay patent locomotive, as built by us, is mounted on 3 independent center bearing, swivel trucks, with 12 steel-tired drivers connected, which are 36" in diameter. The axles are 5½" at center, and wheel fits 6½" with bronze metal journal bearings 6½" x 7". The truck bolsters are made of 12" channel beams, each supported by double coil springs of sufficient strength to carry weight of locomotive, there being provisions made to take up the wear in axles, and for raising and lowering boxes to keep pinion shafts in proper position. There are three cylinders, each 16" bore and 15" stroke, all placed engage the gear rims on the center drivers of the locomotive proper. The fourth or rear section of horizontal shaft has two steel pinions with 18 teeth, pressed and keyed on, which engage the gear rims of the rear drivers, which support the tank; by this means the drivers are all connected. The cylinders all being on one side, the boiler is set to the left of the center, in order to equalize the weight on the track, and make the locomotive in perfect balance. The boiler being set to the left of the center, with the cylinders and all of the engaging machinery on the right side of the locomotive, gives the engineer a full view of the track and of the machinery, which is at all times under his eye. The whole weight of locomotive and tender is on the drivers, and the fuel and water is useful for adhesive power. The frame of locomotive and tender is made of I beams 12" deep. The total wheel base is 42' 6". Rigid wheel base, 56", and total length over all is 53' 8 From center to center of front and middle trucks, 25' 10", and from center to center of middle and rear trucks, 12'. Gauge of track, 56½". Capacity of tank, 2,500 gallons of water and 8,000 lbs. of coal. The weight of this locomotive on drivers when in working order is about 80 tons. One of these locomotives has been in use on the Sinnemahoning Valley Railroad in Pennsylvania, nearly three years, being used for general freight purposes. It will curve where an ordinary box car will, and it is equipped with steam brakes, and if desired can have Westinghouse air brake. These locomotives are built for working on grades of from 3 per cent. to 10 per cent., and will pull behind it up a 10 per cent. grade, 100 tons on a good rail. These locomotives have been successfully built and run for



THE SHAY LOCOMOTIVE.

on the right-hand side of boiler. The boiler is the style known as a wagon-top boiler, and is 52" smallest diameter. Steam dome 28" x 28". Fire-box 79" long, 48" wide and 70" deep. Boiler contains 180 tubes 2" in diameter, and 12' long. The cylinders and frame of each engine are cast in one piece, the cylinders attached at upper end to steam bracket, which is securely attached to boiler and frame, provisions being made for expansion and contraction. The piston rods and connections are all made of steel The valve motion is of the shifting link style, graduated to cut off equally at all points of stroke, links, blocks, lifting links, eccentric rod jaws, rocker and reversing shaft are made of steel forgings. The crank-shaft is three throw, made of solid iron forging with cranks set at 120°, journals 5" diameter. There is a heavy steel gear rim containing 37 teeth, 2¼" pitch, and 7" face attached to the outside face of each right-hand driver. The cylinders, being set vertical on the right-hand side of boiler, are connected to the crank shaft, which is at right angles (or horizontal), and coupled to the crank-shaft are horizontal steel pinion shafts coupled between each set of drivers, and on each side of engine with a flexible universal coupling, and between each pair of these universal couplings is placed a male and female coupling used for the purpose of extending and taking up the horizontal shafts, so as to allow free action of the drivers to accommodate themselves to the curves and irregularities of the track. On the first forward section of the horizontal shaft are two steel pinions, with 18 teeth, pressed and keyed on, which engage the gear rims of the forward drivers; the second section being the three-throw crank, which is connected to the engines, and forms the propelling power The third section of horizontal shaft has two steel pinions, with 18 teeth, pressed and keyed on, which the past ten years, and there are over 300 of them in use in different parts of the United States. The company expect to build 75 Shay locomotives during this year. They are built to weigh from 10 tons up to 80 tons, and for all gauges of track. They are being used largely on lumbering and mining roads where heavy duty is required. Its average speed is from 9 to 14 miles per hour. These locomotives, owing to their extended wheel base, are easy on track, and the design is neat. Owing to their peculiar construction, they set low, and have a neat and roomy cab.

Simple Lessons in Drawing for the Shop.

BY ORVILLE H. REYNOLDS

SEVENTH PAPER

To construct a straight line, which shall be perpendicular to a given line, and equi-distant from two given points, as in Fig. 37, let ends of line A B be the given points, from these points as centers describe intersecting arcs above and below the line; through intersections draw line C D, which will be the required line perpendicular to A B, and dividing it into two equal parts.

A perpendicular can be drawn to any other point on the line A B, by bisecting the distance between given points, as A E or B E, and using same construction as before.

Fig. 38 shows a perpendicular drawn to a line from a point not on the line. Draw line A B, and locate the given point as at C; from C as a center describe an arc cutting the line A B at E F; from E and F as centers, describe arcs cutting each other at D, then a line drawn from C to intersection of arcs at D will be perpendicular to A B, and pass through point C.

To draw an arc of given radius through two given points (Fig. 39), let A B represent the given points; take any suitable radius, as A E, and with A and B as centers, describe arcs intersecting at E; from E as a center, describe arc which will pass through given points as required.

Fig. 40.—To draw an arc which shall pass through three given points, as A B C, take on the compasses any distance slightly greater than half of A B or B C, and with B as a center describe an arc; without altering the radius of compasses, describe from A and C as centers smaller arcs cutting the first at G H and E F; lines drawn through intersection of these arcs will cross each other at D, then A D, B D or C D, taken for a radius, will produce an arc passing through all three points.

Fig. 41.—To describe an arc passing through three given points when the center is inaccessible, let the given points be represented by A B C; from A and B as centers, with radius A B, describe arcs A D and B E; through point C draw A F and B G; divide A G and B E into any number of equal parts, as 1, 2, 3, 4, and set off a number of equal parts of the same length on the upper portion of the arcs beyond G and F. Draw from A to 1, 2, 3, 4, and from B to H I J K; line H will intersect line 4 at point X; line I in line 3, and line J in line 2, etc., the intersection of these lines will be points in the arc, but for that portion of it between C B only; follow the same construction for the side between C and A, and when a sufficient number of points are found they are to be connected by a template, which will take as many of them as possible.

Another method of describing an arc through three given points is given in Fig. 42. A B and C will be the points as before; connect A B by a straight line, also draw from A to C, and from C to B Draw E F parallel to A B; on line A C set off any number of equal parts, as eight; from C as a center describe arcs cutting these equal parts and line E F; divide arc A E into a similar number of parts, and draw from C to the equal parts on arc A E; the intersection of these lines with the arcs drawn from A C to E F will be points in the curve, which must be connected as before

Fig. 43 shows how to construct a circle by points. Lay off A B the given radius; draw A C and B D perpendicular to A B, and equal to it; next divide the line A B into any number of equal parts, and line B D into a similar number of equal parts, continue line C A to E, and make A E equal to A C.

Draw from D, through points on A B, indefinitely; from C draw to points on B D; these two series of lines will intersect at 1, 2, 3, 4, etc., and will be in the circumference of circle of which A B is radius.

The points are to be joined by a template, as in the case of Figs. 41 and 42. A quadrant or fourth part only of the circle is shown laid off; the three other quarters can be done in same manner, producing a complete circle. A template for any particular curve can be easily and quickly made, as recommended for Fig. 25 (fifth paper). A reference to this figure will show an ellipse, in which the intersection of horizontal, vertical and radial lines form points in the curve.

Another construction is shown in Fig. 44, in which the curve is formed with the compasses, being made up of four circular arcs. This method, it must be remembered, is only an approximation to a true ellipse, which the compasses cannot make mathematically accurate. The reason for this is that an arc of a circle is not any part of an ellipse, but the simplicity of Fig. 44 makes it convenient for the draftsman to use when absolute truth is not required.

To describe this ellipse, make the minor axis *C D* perpendicular to the major axis *A B*; from *B* on line *A B*, lay off *B F* equal to *E C* or *E D*; from *E* on line *E C*, lay off *E G* equal to *E F*, produce *G F* and bisect it at *I*; from *F* lay off *F J* equal to *F I*; draw *J K* parallel to *G F*, and from *E* lay off *E L* and *E M* equal to *E J*; draw through *K L M L* and *J E J M*, and produce indefinitely; the angles of the square formed by *J K L M* are the centers from which the figure is to be drawn. From *J* and *L*, with *A L* or *J B* for radius, describe arcs cutting *N P* and *O Q*; from *K* and *M*, with radius *M C* or *K D*, describe arcs joining *N P* and *O Q*, completing the ellipse. It will be observed in this figure, that when two circular arcs are tangent to each other, that their centers are in a straight line passing through the point of tangency.

In Fig. 45 we have the construction of a spiral, as follows: On any line, as *A B*, lay off the two points *B* and *C*; with point *B* as a center describe semi-circles *D E F G*, with radii equal to *B C*, *B D*, *B E* and *B F*; with *C* as a center describe arcs *C G*, *C H*, *C I*, etc., joining *B C*, *B D*, etc., completing the figure. This method is not strictly correct, because true spirals are not made up of tangent arcs, it is, however, accurate enough for ordinary practical work.

How to divide the circumference of a circle into any number of equal parts is shown in Fig. 46. Describe the circle, and taking the radius on the divider points, set off six equal divisions, as *B, C, D, E, F, G*. From *B* to *E* is the diameter, and divides the circle into equal parts, *B D* is the chord of one-third of the whole circle, therefore *B D*, *D F* and *F B* divides the circle into three equal parts. Taking for a radius the chord *B D*, and with centers at *B* and *E*, describe arcs cutting each other at *X* above the diameter, and *X* below it. If distance *A X* be now set off from *B* and *E*, the circumference will be divided into four equal parts, as *H, B, I* and *E*.

With radius *A B*, describe arcs from *X* and *X* as centers, cutting circumference at *K L M* and *N*, this will bisect quadrants *B H*, *H E*, *E I*, and *I B*, and divides the circumference into eight equal parts.

With radius *A B* lay off from *H* and *I* the distances *O P Q R*, which bisects the arcs *B C*, *D E*, *E F*, and *G B*, completing the tri-section of each quadrant, and dividing the circumference into twelve equal parts.

The radius *A B* laid off both ways from *K L*, *M* and *N* as centers, will bisect the two arcs on each side of the ends of the diameters *B E* and *I H*, in *S, Y, U, T, W, Z*, etc., and divide the circumference into 24 equal parts.

Other subdivisions may be made indefinitely by bisecting the arcs already divided, as a bisection of the 24 parts just found will divide the circle into 48 equal parts.

This construction, it will be observed, is done with three distances—the radius *A B*, the chord *B D* and distance *A X*. To insure accuracy in laying off of the subdivisions, the points named must be kept true and free from mutilation by the divider points, which can only be accomplished by careful handling.

Fig. 47 is a further demonstration of equal divisions, to show how a circumference may be divided decimally, same letters of reference will be used for convenience With distance *A X*, and *O, P, Q, R*, as centers (assuming these points to have been found as before) describe arcs cutting each other at *Y* and *Y* on line *A X*; take the distance *B Y*, on the dividers, and set off *B, C, D, F* and *G*, dividing the circumference into five equal parts.

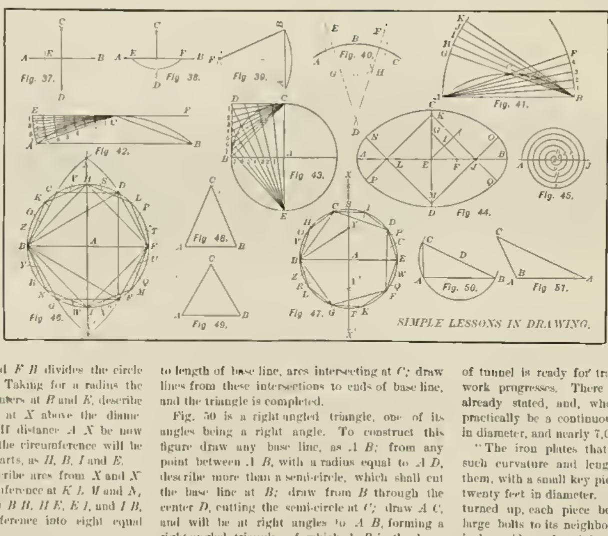
Bisecting the arcs *B C*, *C D*, *D F*, *F G* and *G H*, with distance *A Y*, the circumference is cut at *H, I, E, K, L*, and divided into ten equal parts.

Laying off the distance *B Y* from *S T*, perpendicular to diameter *B E*, will bisect arcs *D E*, *B H*, *E F*, and *B L*, in the points *U, V, W, Z*, and we have the circumference divided into twenty equal parts.

Bisecting arcs just found, we get forty equal parts, etc These constructions are time savers as compared to the cut-and-try process. Their value is apparent when drawing polygons, or dividing the pitch circles of toothed gearing.

Fig 48 is an isosceles triangle, so called because two only of its sides are of equal length; to construct this triangle, draw base line *A B*, and from each end of base line as a center describe arcs of any equal radius intersecting at *C*; draw from *C* to extremities of base, and figure is complete.

An equilateral triangle is one having all its sides of equal length, as in Fig. 49. To construct this triangle, draw any base line *A B*, and from each end of same as a center describe, with a radius equal to length of base line, arcs intersecting at *C*; draw lines from these intersections to ends of base line, and the triangle is completed.



SIMPLE LESSONS IN DRAWING.

Fig. 50 is a right angled triangle, one of its angles being a right angle. To construct this figure draw any base line, as *A B*; from any point between *A B*, with a radius equal to *A D*, describe more than a semi-circle, which shall cut the base line at *B*; draw from *B* through the center *D*, cutting the semi-circle at *C*; draw *A C*, and will be at right angles to *A B*, forming a right-angled triangle, of which *A B* is the base, *A C* the perpendicular, and *C B* the hypothenuse.

Fig. 51 represents a scaline triangle, *i. e.*, one in which no two of the sides are of equal length, and not one of the angles a right angle; to construct such a triangle, draw base line as before, take *A* and *B* as centers, and with any radius, as *B C* and *A C*, describe arcs intersecting at *C*, from which draw *C B* and *C A*

Believing that these and the foregoing problems cover sufficient ground for an elementary work, and it not being our purpose to treat the subject exhaustively, we will take leave of them for the present.

The St. Clair Tunnel.

A correspondent of the Boston *Transcript* gives the following interesting description of one of the greatest engineering projects of the day.

"Six hundred men are now digging the railroad tunnel under the St. Clair river, at Port Huron, at the rate of fifteen feet each day. More than 1,200 feet of the tunnel proper is now ready for trains on the Michigan side, and 900 on the Canadian. The remaining 4,000 feet will be finished at a wonderfully rapid rate, considering the nature of the work.

"The tunnel is over 6,000 feet long. The approaches are equally long, so that the entire length will be more than two miles. Of this distance 2,310 feet are under the river, 2,390 feet on the Michigan land side, and 2,100 on the Canadian. The grade is one foot to every fifty, except under the river bottom, where it is substantially level. It is an iron cylinder tunnel—the only one of the kind in the country. There is neither brick nor stone used in its construction. Neither are there any stays or supports—simply a mammoth iron tube built in sections underground. It is designed for a single track.

"Electric lights make it as light as day, air engines keep the atmosphere as healthy inside as above, and steam pipes hold the temperature at the proper point. It is as dry as a street in summer, and the disagreeable features common to subaqueous work are entirely absent. Work is pushed from both ends.

"The method of construction is simple. A great cylinder, weighing more than sixty tons, twenty feet in diameter and sixteen feet long, is driven into the blue clay, which constitutes the entire bottom of the river, by the use of hydraulic power, with as much ease as cakes of soap can be carved out of a general mass. Inside this cylinder, which is called a shield, twenty-two men are at work, removing the dirt. As fast as the shield is pushed forward, which is about two feet at a time, the clay thus brought inside the shield is dug out to the edge of the great cylinder. Then the hydraulic jacks are again started, and slowly, but irresistibly, the immense iron tube moves another two feet into the solid earth ahead of it. Each jack has a power of 3,000 tons, and the combined power behind the shield is more than 400,000 tons.

"Another ring of iron lining is put into place, and each foot of tunnel is ready for track laying as fast as the work progresses. There is no mason work, as already stated, and, when done, the tunnel will practically be a continuous iron tube twenty feet in diameter, and nearly 7,000 feet long.

"The iron plates that form the lining are of such curvature and length that any thirteen of them, with a small key piece, will make a circle of twenty feet in diameter. The edges and ends are turned up, each piece being bolted by a dozen large bolts to its neighbor Each one is eighteen inches wide, and weighs as near 1,000 pounds as the foundries can make them."

M. M. Mehan, traveling engineer of the Duluth, South Shore & Atlantic road, has placed us under obligations to him for eight views of their rotary snow-plow at work. These instantaneous views show just what can be accomplished by this powerful machine. Some of the views show the plow piling up the snow 75 feet from the track, cutting hard snow four feet deep. One view shows a solid trench, nine feet deep, where a side track was unearthed. A north Michigan winter is made on purpose—even the pictures look cold

F. C. Robinson, master mechanic of the Atlantic & Danville, at Portsmouth, Va., one of The Locomotive Engineer's earliest and best friends, has just been made General M. M. of the Chicago & West Michigan road. Mr. Robinson has come up from the throttle since this paper was established; he is only one of many who are going up and have only just started.

The Master Mechanics' Association will meet at Old Point Comfort, Va., on June 17th.

Management.

By J. E. Phelan.

How easy it is for a person to get set ideas and know it all, can be best understood by viewing now and then living examples of self-asserted wisdom.

When we fully consider how very little is really known by the wisest of men, it teaches us to believe that knowledge can be shared by rank and file without any chance for monopoly to any individual or company of men.

If we stop to consider the fact that in the aggregate the management of a railroad system of the present day exceeds in magnitude and diversity of talent employed, the ancient political systems set up for the government of serfs or people, we may begin to think that there exists room for diversified talent and industry in various degrees.

If we are to set our minds on the degrees of expansion encompassed in the creation of the world in six days, and when completed have the whole machinery of creation encompassed within the garden of Eden, with Adam as general manager or superintendent of motive power, we can very easily come in line to consider that there is not much to it any way, and that Adam may be fully competent to be general manager or superintendent of motive power and special head of all the other departments, or portions of the menagerie, without any especial need for assistance in any direction.

We often meet men who believe in letting matters run themselves. We have known men to occupy official positions who considered it a point of wisdom, thinking the most successful way to handle a department was simply to let matters run themselves—and the main duty of the officer so thinking, seemed to consist in showing up regularly and drawing a salary.

Such a management is all right under certain conditions.

But in successful railroad management the easiest way is not always the best way. Just as surely as the human body depends for health on good food and the observance of stated laws, just so surely does the successful management of a railroad depend on the observation of stated rules, pure principles of action, and vigilant performance of duty, on part of all employes—officials and others.

The weakness of human nature and the tendency to err is ever recognized. The old way in subjecting a serf, seemed to be in lashing into subjection, and bulldozing into line of duty.

But it is surely now time to have an age of reason, where intelligence may guide.

The correct principle of management in railroading is to govern by law, and have matters run in an orderly fashion.

Where this principle can be inculcated, from the general manager down to the humblest employe, we find matters running smoothly and according to rules—or law and order.

Railroads are conducted for purposes of revenue, and revenue is derived from traffic.

In looking after the various departments in the management of railroads, diversified talent is necessary.

In the complicated and intricate workings of railway management of the present day, for one man to say he knows it all is the height of folly.

The operating department of a railroad is a most essential part, and unless properly conducted gets away with more than a proper percentage of the revenue.

As a part of the operating department, the machinery department is especially a gormandizer of earnings, unless properly and economically conducted, and watched with untiring vigilance.

Here is a field for industry, patient research, and persevering diligence, not comprehended excepting by those who have burned the midnight oil in attaining profitable results.

In a well-conducted machinery department there is plenty of room for the superintendent of motive power, the master mechanics, the master car builder, the mechanical engineer or the engineer of tests, the general foreman, *the road foreman of engines*, and all the other employes of various grades of employment, even to the clinker pit man, who stands on the bottom round, but at the same time available for promotion.

This machinery department is an interesting industrial world in itself, to all excepting those who fail to comprehend its principles, and believe that such a combination can run itself, without effective guidance from an intelligent head.

To say that the mechanical engineer has a soft snap, simply because his duties are not fully comprehended, would be the evidence of vain imagination.

Go through the official list, and not any one has more intricate and interesting duties than the road foreman of engines, or traveling engineer.

But the traveling engineer identified with a successful management must be thoroughly competent and intelligent, and must do business in a manly way.

His duties must be in line of attaining successful results; in line of economy in caring for machinery, and properly conducting traffic.

With a system having several hundred locomotives, all equipped with modern improvements; with every engine and train, freight or passenger, equipped with automatic brakes; with an army of enginemen anxious and willing to do duty, and ever ready to follow intelligent advice, in line of good service, the traveling engineer enters a fascinating field, and can show abundant results from labor performed.

An incompetent traveling engineer should not be kept in service any longer than an incompetent wiper.

A competent traveling engineer having opportunity for consulting with the superintendent of motive power, the master mechanics, the mechanical engineers, draftsmen, and various foremen, mechanics and engineers, has a splendid opportunity for gaining diversified knowledge, and should be able to convey a profitable percentage of it to his associates on the road, where all the force can unite in a harmonious effort in doing right and performing duty.

When this subject can dwindle to the mere impression, not attaining force enough to create an idea, of a being occupying excessive space in a locomotive cab, to the discomfort of an engineer or fireman, it certainly seems like parties going rabbit hunting, who, while attempting to grab the head, simply catch at the nether extremity.

However, we will say the traveling engineer who does not know enough to properly locate himself in an engine cab, and get out of the way of engineer and fireman, has yet something to learn.

Talk is cheap; while the muffins made up from leaky vaporings around a roundhouse, while interesting to the taste yet lack body and nourishment, desired by the average individual.

Results are valuable. The many can read back numbers of The Locomotive Engineer with profit in valuable results.

From our observation in the past, where railway management is conducted economically and with profitable and intelligent results, all men retained in position have found opportunity to earn their salaries, we have not noticed many enjoying sinecures in our part of the country. The value of any employe, official or others, can be solely determined by results. To attain such results, intelligent efforts are at all times necessary.

Among the various employes, we know of none who can show better results than those accomplished by the industrious efforts of the intelligent traveling engineers.

The Schenectady Works are building a 10-wheeler and a consolidation compound for the E. T. V. & G. They are also building another 10-wheeler for the Michigan Central, but will reduce the size of each cylinder one inch, making them 19 and 28 x 24. The compound in service is on freight and doing well, but would not make up time on passenger. It has been found that all the compounds do extra well on trains of a certain weight, and drawn at a certain speed, and not so well on light and heavy trains—they are not so good all round engines as the simple ones, but are coal savers on work proportioned to their design.

Headlights have come down in price wonderfully of late, ten or fifteen years ago they were worth about $100, five years ago $60 to $70; now you can get a pretty good one for $25.

Pedrick & Ayer, of Philadelphia, have undertaken the manufacture of the Richards open side planer, which adds greatly to their work, and has caused them to commence the erection of two more stories to their present shop; when complete, this will be one of the neatest and most complete manufacturing plants in the business.

J. H. Vreeland was M. M. of the Jersey City shops of the Erie from 1876 to '89. About a year ago Mr. Vreeland resigned, but the boys thought enough of him to go down to his house one evening last month and present him with their respects and a gold watch and chain.

Correspondence

Lighting a Headlight.

Editor The Locomotive Engineer:

I know a little kink about lighting a headlight on stormy and windy nights. Take an old train order and curl it around on top of the lamp wick so as to leave a portion of it sticking up, and, by dropping a lighted match down the chimney it will ignite, and the headlight is lit. You will find this way much easier and quicker than the old way of putting a coat over your head. A Fireman.

Jackson, Mich.

He Was There.

Editor The Locomotive Engineer.

My Friend Davis, engineer of Newton City Water Works, loaned me a February number of The Locomotive Engineer. In it I find two accounts of the blowing up of engine "Neversink," P. & R.R. By referring to my time book I find the following:

"Thursday, January 14, 1847, engine "Neversink" blew up. Eight men killed." I was told it happened at or near Mill Creek Bridge.

I was working in the Reading shop at the time, as a machinist in John Dodsworth's gang. Lewis Kirk, Master Mechanic. John Bourne.

Newton, Kansas.

Before the "Neversink."

Editor The Locomotive Engineer:

At the risk of being thought "obstinate" by my old boss, S. A. Alexander, I submit the following: The case to which he evidently refers was before the "Neversink" explosion. It was a Norris engine, name forgotten, and happened near Reading during a violent thunder-storm. My informant said he was a witness to the transaction. Railroad men who examined the engine said it was caused by using cast-iron stay bars across the top of the crown sheet of the fire-box. The "struck by lightning" theory was advanced, I think, by a Dr. Lardner, an English scientist, without seeing the boiler, and was laughed at by those who examined the boiler after the explosion.

Newton, Kan. John Bourne.

Setting Valves.

Editor The Locomotive Engineer:

I once saw in a scientific paper, instructions about setting a slipped eccentric, to wit: take out pin (supposed to mean pin in end of blade), turn eccentric until pin will go in hole, fasten eccentric, and go. The above is about as vague as Mr. Campbell's pointers, so far as I can see them. Yes, valve motion is equal vibration of rocker arm, but suppose it don't vibrate at the right time, or suppose, for argument sake, it is a direct-acting motion. Don't know that I ever saw reamed holes in back end of blade; if so, what is the oblong hole for? The man who can set valves in ten minutes is a dandy. Would gauge a valve by putting it back until steam just showed at front cylinder cock, mark stem, and push ahead what you know lap to be, and mark; get back end same way—would set eccentric same way, allowing engine to be on center. Yes, lost motion does have something to do with an engine working well; they are slow about taking steam, and when they get it they slip badly.

Corry, Pa. W. de Sanno,
Engineer and Machinist.

More About that Cranky Injector.

Editor The Locomotive Engineer:

We have noticed the complaint made by "West Oakland," about the "cranky" behavior of a No. 8 "Monitor" injector on the right-hand side of his locomotive. Your editorial comment very fully answers the correspondent's complaint. We do not think that the party made a new steam nozzle, or made it too long, but it is more likely that, after removing the injector nozzles, he did not screw the steam nozzle down to its shoulder, which would have just the effect described by him. We would suggest to him to look for leaks in the packing of the water valve, to see whether the overflow check valve is tight, or admits too much air, and whether his main boiler check has a sufficient lift. All other probabilities are mentioned by you. The fact that the left-hand injector works perfectly satisfactory seems to establish almost beyond a doubt, that the trouble complained of is *outside* the right hand instrument.

NATHAN MFG. CO.
Per J. W. MACK, *Treas*

Slipping Drivers in Going Down Hill.

Editor The Locomotive Engineer:

In your issue of April 1 notice a letter signed R W. Sizer, describing the slipping of his engine on going down hill, and also your editorial comment.

I believe Mr. Sizer may be quite right, as I have met with several engines which have been reported as doing the same thing, and it is invariably found that the wheels are out of square, that is, the crank-pins are more or less than 90 degrees apart, or some of the crank-pins are bent, which amounts to the same thing in effect. I believe the slipping is caused by the resistance of the side rods preventing the engine from running as freely as the train, and the train then pushes her down hill. This might easily be verified if a revolution counter were placed upon the engine.

Montreal, Can. R. ATKINSON.

[If the side rods or any other part of the engine binds or runs hard, it would tend to retard the motion of the wheels, and cause them to revolve *slower;* as we understand Mr. Sizer, the wheels slip *ahead* enough so that it is necessary to give the engine sand to stop the slipping; we have no doubt that any defect in the machinery would prevent the wheels from revolving fast enough; but what can cause them to slip too fast?]

Another Dope Receipt.

Editor The Locomotive Engineer:

In April issue of THE LOCOMOTIVE ENGINEER I see our friend A. W. Mason furnishes our boys with a very valuable receipt for cleaning and polishing brass. Bro. Mason's receipt is good, but we think we can improve it a trifle, as we have made the same dope, and used it and experimented on it; find we can do better work with the following

1 pint sperm oil.
½ ounce camphor gum, pulverized.
¼ ounce oxalic acid, pulverized.
¼ ounce arsenic.
2 ounces fine emery flour.
Tripoli to thicken to a paste

Place the sperm oil in a can or bucket, set it over a fire, bring the oil to a slow boil; place the camphor gum and oxalic acid in the hot oil, stir until entirely dissolved, when add tripoli emery and arsenic; use tripoli enough to make a thick paste. This will always stay as a paste and not get hard. Our reason for not using sperm candles is they make the dope hard. Emery flour is better than bath brick. Bro Mason furnishes a good receipt, but our experience is that for hot and cold brass the enclosed is better.

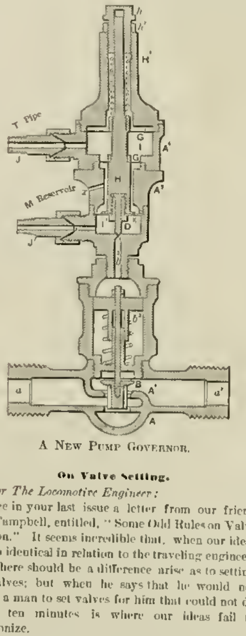
Denver, Col. CACTUS

The Lake Shore Accident and the Sweeney Air Compressor.

Editor The Locomotive Engineer:

In your article in April number about the Lake Shore accident near Buffalo, you say that "after the conductor stopped the forward part of the train he jumped off, and, seeing the danger, signaled the engineer to go ahead, the engineer tried to release brakes, but could not." I suppose that the conductor did not close the valve, so that when the engineer put his valve handle on the release, his air pressure in main reservoir went through his train pipe and escaped through the open conductor's valve, so that pressure could not be maintained in the pipe or underneath the triple valve long enough to release brakes. If that engine had been equipped with the "Sweeney air compressor attachment" the engineer could at any time release brakes when either standing still or running. You are probably acquainted with the construction of that device, which connects the steam chest and cylinders of an engine with the main air reservoir, and when an engine is in motion the cylinders may be used to compress air. But in the case of the Lake Shore accident, when the train was stopped and brakes set, or as in that case at Spuyten Duyvil, the valve on steam chest could be opened, and full boiler pressure of steam forced back to release brakes, even though there were one or two valves open pressure sufficient could be maintained to keep the brakes released until all danger was passed. After using the Sweeney device in that way there may be condensed steam in train pipe, but if one life is saved it were better even if the whole brake apparatus was destroyed; but the brake is supplied with so many bleed cocks, which, if used immediately after, no injury will be done to the brakes.

Sacramento, Cal. T P SWEENEY.



A NEW PUMP GOVERNOR.

On Valve Setting.

Editor The Locomotive Engineer:

I see in your last issue a letter from our friend Mr Campbell, entitled, "Some Odd Rules on Valve Motion." It seems incredible that, when our ideas are so identical in relation to the traveling engineer, that there should be a difference arise as to setting of valves; but when he says that he would not allow a man to set valves for him that could not do it in ten minutes is where our ideas fail to harmonize.

I would like to sit on a brow of a hill and listen to one of his engines exhaust whose valves were set in ten minutes. You may set *at* them in that time, but it is an impossibility to square them, providing they are out in the least. I think his rules are a little ancient; they are a little Greek—or probably the printer has again made one of his errors in setting the article.

If Mr. Campbell's idea is setting valves by running an engine over in her extreme travel, with steam, of course I concur with him on the ten-minute time; but that is not squaring valves. I also disagree as to the amount of lost motion in an engine's valve motion; let there be any great amount of lost motion in eccentric straps, links, rocker-boxes and valve yokes, and it is an impossibility to square an engine. You may run her over a dozen times, and find different results each time; if you happen to get her right at one point of the quadrant she will be out in another. I have often had engines where a scale and valve gauge were useless, then I would square them to sound, as it would be impossible to square them to measurement.

I claim that squaring a set of valves correct is one of the most important jobs on a locomotive; it may seem very simple to divide the lead or to shorten or lengthen a blade, but that is not all, by any means. How often has it occurred to your valve setter, that when you think you have her correct, her lead right, and she seems to measure square on the crosshead, to use an equal amount of steam on both ends or on both sides of the piston; but when she went out you could distinguish an uneven sound; so you give her another whirl, probably two, before you get her right? I do not say that this occurs to every engine, but it does happen sometimes. I concur with Mr. Campbell when he says it will surprise a superintendent or engineer to take an old engine and square her in ten minutes so she will do the work and haul as many cars as she did in her first days. It must surprise the superintendent very much.

Oakland, Cal. W. D. HOLLAND.

A New Air-Pump Governor.

Editor The Locomotive Engineer:

I send you herewith, drawing of a new air-pump governor of my own design, that has, I think, advantages over any other kind.

In order to make the matter better understood, I will mention some of the objectionable results obtained by the present governors now in use (1) In both the Westinghouse and Mason governors, there is but one controlling pressure connection, and that is in communication with the train pipe pressure.

We will consider that we have started the pump, and the desired train pipe pressure of 70 pounds per square inch has been attained, and the pump stopped, as we have a feed valve in the engineer's valve, which reduces the pressure 20 pounds per square inch between the train pipe and main reservoir, we will therefore have a pressure of 90 pounds in the main reservoir

If, now, we reduce the pressure in the train pipe 8 pounds, as by setting the brake, the pump will start and pump an additional pressure in the main reservoir, until the train pipe pressure is restored to 70 pounds, or if not restored in a reasonable length of time, until the pressure in the main reservoir attains a pressure equal to the pressure of steam carried in the boiler (as with an 8" Westinghouse air-pump, you can pump as much pressure as there is steam pressure actuating the pump). If, now, the pressure in the main reservoir has been allowed to run up to boiler pressure, say 140 pounds per square inch, and if, now, the engineer releases his brake by restoring the pressure in the train pipe, this 140 pounds in the main reservoir equalizing throughout the train pipe and auxiliary reservoirs, will reduce the pressure about 3 pounds per square inch in the main reservoir, on an average train; and allowing our feed valve to hold 20 pounds per square inch, we will still have a pressure in the train pipe and auxiliary reservoirs of 117 pounds per square inch available to set the brake, which is 47 pounds per square inch in excess of desired pressure to be available to set the brake. If now, the brake be set, there would be a tendency to rupture brake rigging and slide wheels flat. This objectionable feature is increased as the steam pressure in boiler is increased; for even now it is not an unusual thing for a locomotive boiler to carry 165 to 180 pounds per square inch.

(2) Again, we will consider that we have our normal pressure of 70 pounds in the train pipe, and 90 pounds in the main reservoir as before. If, now, we use air out of the main reservoir for any purpose, such as ringing the bell, manipulating the fire door, moving ash-pan slides, train-signaling apparatus, car lighting, sand jet, or if there be a leak in main reservoir and connections, then the pressure in the main reservoir will be reduced to that of the train pipe, or even lower, before the pump will start, and when it is reduced that low the brake will drag, as it requires a reduction of pressure in train pipe to start the pump. Therefore, with the two governors alluded to, the air direct from main reservoir is not available for use, and it is not desirable to use air from the train pipe for other uses, as it causes the brake to set and drag.

(3) Now, in my "automatic pump governor,"

I overcome these objectionable features by using two controlling pressure chambers and connections. One as connected at *J*, to train pipe, and one as connected at *J'*, to main reservoir.

We will now consider the same circumstances as in preceding case; we will consider that we have started the pump, and the desired train pipe pressure of 70 pounds has been obtained; we also now have an increased pressure of 20 pounds in the main reservoir as before, which is 90 pounds.

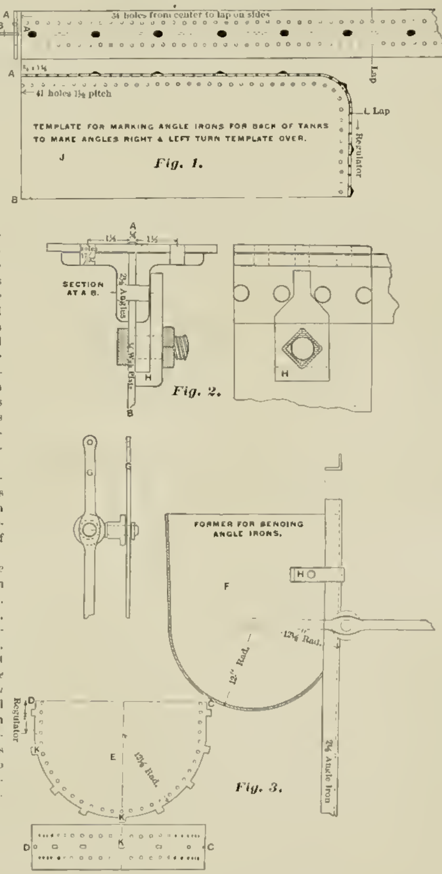
If, now, we reduce the pressure in train pipe, as by setting the brake, the pump will start; supplying to the main reservoir a surplus pressure above the normal (90 pounds), to be available to restore the train pipe pressure and release the brake. But this condition of things is not permanent, during the entire time the train pipe pressure may remain below the normal, 70 pounds, for if it remains so for any length of time the surplus pressure in the main reservoir at length reaches a pressure where it will stop the pump. And since the degree of surplus pressure in the main reservoir necessary to do this depends upon the amount of the reduction of pressure in train pipe, it is evident that the surplus pressure in the main reservoir will not always be the same, but will bear a fixed ratio to the reduction of pressure in the train pipe. That is to say, if a reduction of 5 pounds pressure below the normal in train pipe requires an excess of 2 pounds above the normal in the main reservoir to stop the pump and restore the train pipe pressure, then a train pipe reduction of 20 pounds will require an excess of 8 pounds above the normal in the main reservoir to accomplish the same result. It will be seen that my governor automatically meets the requirements of every case, and stops the pump when, and only when the proper pressure in train pipe and main reservoir have been obtained.

There is therefore no danger of rupturing brake rigging or sliding wheels flat, as no excessive pressure, as cited in the other case, is impossible, and unnecessary pumping, involving waste of steam and wear of pump, is prevented.

(2) Again, we will say that we have a normal pressure of 70 pounds in train pipe, and 90 pounds in main reservoir. If, now, we use air from main reservoir, direct, for ringing bell, etc., as mentioned before, any reduction of pressure, by so using air, will immediately start the pump, *not requiring, as with the other governors, a reduction of train pipe pressure to start the pump*, but will start the pump, irrespective of the train pipe pressure, and will continue pumping until the main reservoir pressure has been restored; there is therefore no dragging of the brakes, and there is always a pressure maintained in main reservoir to successfully operate the brake.

J. A. STEININGER.

Creston, Iowa.



SYSTEM OF TANK TEMPLATES.

Wants a Higher Court.

Editor The Locomotive Engineer:

Dr. Talmage, in his sermon on "Angelology," paid a glowing compliment to the locomotive engineers, by saying they were "about the grandest men alive." I read that part of the sermon several times, and then called the attention of some of my friends to it, and I want to say that those are my sentiments exactly. I have for some years had a hankering to be traveling engineer, master mechanic, or superintendent of a railroad, so that I might try the experiment of treating the employes with common civility and justice. As it is now on most roads, if a man gets into trouble he gets the grand bounce, whether he is or is not to blame. Several instances of this nature have come under my observation; men with remarkably clean records have been laid off permanently, for some trivial offense, for which they were in no way responsible. This is all wrong, and whenever I hear of such a thing it makes my blood boil to such an extent that my Quaker lineage is forgotten, and I ache to perform the J. L. Sullivan act with some one.

An engineer of my acquaintance, once tried to get past a freight train on a single track; two engines were completely demolished, and three men killed. The superintendent, who happened to be on the train, extricated himself from the wreck, and going to the engineer said, "What are you doing here?" The answer was, "I have orders to be here." Then said the superintendent, "You had no business to run by your orders." No blame could possibly be attached to the engineer—but he was discharged all the same, and the crank who made a mistake in the orders lied out of it, and is still in the employ of the road. There should be some way for an innocent man to vindicate himself, and it cannot be brought about too soon.

I have seen the Swinerton locomotive, felt for the flat spots on the tires, and decided that I had been imposed upon. The runner in charge asked if I expected to find a hex nut for a tire; then he produced a steel straight-edge, and I saw more than I could feel. I have been much amused at the way the daily papers have described this engine as "running by compressed air," "piston rods connected directly to the truck wheels," "a patent balancing device," etc.

The old locomotive "General," of the Western & Atlantic R. R., of Georgia, of which mention was made in the April number, is an interesting relic of the war, and as such should be preserved in the National Museum at Washington, D. C. Let me here suggest that the locomotive engineers of the country chip in and purchase this locomotive, with a view to its preservation as above mentioned. And what is the matter with sending such contributions to the editor of THE LOCOMOTIVE ENGINEER? Don't all speak at once. BAX.

Rahway, N. J.

System of Building Locomotive Tanks by Template

Editor The Locomotive Engineer:

Locomotive builders, whether private or corporate, who have a number of tanks to build of standard dimensions, will find this kink worthy of consideration. *J* is a template to mark angle irons for back and sides of tank; two other templates are required to complete the system, one for semi-circle at front of tank, as shown at *E*, and one for corners in coal bunker, not shown on sketch, as the principle is the same for all three templates; also one regulator to lay off holes in straight part of L's. Template *J* shows one half of tank in width, two angle irons marked one from each side of this template will form angles for top or bottom; the same applies to the other templates. Angles butt together at center of tank, and continue alongside without break to semi-circle at front *c* template *E*. Angles from *L* to be laid off with regulator, using holes marked from template to set regulator. The same applies to angles in coal bunker, to corners from *D* template *E*.

A and *B*, section at ends of template Fig. 1. *C* and *D* cover plate for template *E*. *E*, template for marking front angle irons. *F*, block or former for bending angle irons. *H*, clamps to hold angles in place. *J*, template for marking angles *R* and *L*. *G*, lever with wheel for bending angles. *K*, notches to rivet cover to bed plate.

Templates, as shown, are made from ¼ inch steel, and should be made from material of the same thickness as is used in tanks to be constructed. Web-plate templates may be made any thickness by allowing for same, but cover-plate template should be of same material, as the cover plate is laid off from same regulator as back, sides and front sheets, and any difference in thickness will show in holes when plates are bent. Height of tank will not be a factor. The former for bending angles is clearly shown, and needs no explanation. All that is wanted is a good flange fire where you can get a long heat, or, still better, a small furnace, that would heat about the length you require, which in this case would be about 40 inches, a good size boy can pull lever around. Any shop or R. R. having a standard tank can save cost of formers and templates in the first four tanks made; all parts are interchangeable. A piece can be got out from templates at any time if needed, saving time of straightening out old piece to mark new one; a new piece can be got out and punched while cutting out damaged piece.

It is a good plan to keep a set of templates for sides, back and front sheets, a set means one side sheet, one back, one front, and half of top sheets, top and bottom are the same, except that manhole is left out in the bottom sheets.

JAMES HERON.

Rev. John Brunton, of Pueblo, Col., one of the oldest locomotive engineers in the country, is anxious to correspond with any brother who attended the Baltimore convention in 1855—that was before the day of the present Brotherhood. Who was there?

LOCOMOTIVE ENGINEER. DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

A Modest Invention—100 Miles Per Hour.

It was the writer's lot one day last month to listen to an explanation of a device designed to pull 10 and 15 car trains, at the rate of 100 miles per hour, on the modest expenditure of something like 150 horse-power per day, for 250 or 300 trains.

The United States Pneumatic Railway Co., 607 Chestnut street, Phila., Pa., are the owners of this wonderful device. They have an elaborate set of offices and a 30-foot track on which a car moves back and forth, driven by a steam pump.

The plan is to lay a tube between the rails with a slot in the top; this slot is covered with slides six inches long, and they are moved out of the way of the grip by a track on the car, and closed behind it in the same manner. The grip is firmly riveted to a double-headed piston, packed with leather, one head being in front of the opening, made while car is moving, the other behind. The idea is to set pumps to work to pump the air out of the forward end of the tube and into the rear, thus forcing the piston through the tube and pulling the train with it. The inventor himself explained the device, and his explanation is entertaining, not to say astounding.

He explained, by way of preface, that it cost the P. R. R. over a million of dollars a year for coal, and that the life of a locomotive was but five years at best, and one-third of this time was spent in the repair shop; locomotives had to be repaired after making so many miles, whether worn out or not. His device would not wear out, he could put it on the P. R. R., and pull all their trains between New York and Philadelphia at the rate of 90 miles per hour, by having a ten-horse air-pump every seven to ten miles—he had to run the air-pump he had as fast as it would run to move the little car back and forth while he talked.

How big a tube would he use? Oh, six to twelve inches—fifteen at the outside would pull ten or twelve cars to a train—of course, would have to double the size of wheels under the cars to decrease the friction to what it was now.

How about grades? Oh, grades make no difference at all—you see we have compression on one side and vacuum on the other; when you get a vacuum on anything almost any load can be handled.

About stopping? Why, the easiest thing in the world. Open the valve in the piston, and the air goes through, air from the pipe will supply the air-brakes, but they will not be used, the air going into the vacuum would stop; an express train running 100 miles per hour could be stopped in less than 100 feet—easy enough.

Power was almost nothing; you simply take air from one end and put it in the other, and hitch the trains on as it passes along.

The size of the piston has nothing to do with pulling the train—fifteen inches enough for the heaviest.

It will only cost $10,000 per mile.

No locomotives, or shops, fewer men in train crews, no coal bills, no striking engineers, and 100 miles per hour.

Baldwin Locomotive Works are scared about the thing, and their chief engineer has been there, *incog.* to see if they can't get up something to beat the pneumatic, but they are destined to run against a snag when they get to the patent office.

That is the veriest outline of his explanation. Nothing is impossible with him.

The grade of the track or weight of the trains are not worth figuring on; the area of his cylinder—the tube—is of little importance, the vacuum does the business—stopping and all—we are inclined to believe there will be a great deal more stop than start. This inventor is more fortunate than most of his fellows, he has a company behind him, and people are daily importuned to take stock in the concern. Notices to the effect that stock is for sale are on every hand.

Some of the peculiar locomotives recently turned out have the advantage that they will actually run on the road, they cost more and do less than ordinary locomotives, but they will go; but this scheme has neither novelty or merit, its chief component is the presumption of its projector in ignoring even the first principles of mechanics, setting aside the laws of nature and presuming upon the ignorance of all who come to see his toy.

It is a lamentable fact that such visionary schemes can secure financial backing, while many deserving inventions cannot get a start at all.

The reason is plain, however—a legitimate invention, one that does not make new or destroy old laws of physics cannot offer the dazzling chances of making big money that the wild-cat invention can. The wilder and more unreasonable the scheme the bigger promises it can make, and, the more suckers with money it can take in.

The Polygonal Driving Wheel.

Two months ago we mentioned the fact that the Swinerton polygonal wheel was about to be tried on the elevated road, and that we stood ready to be convinced for or against it on its merits.

The flatted tire were placed under engine 19, a Forney locomotive of the standard elevated pattern, and the sand-boxes left off. The elevated roads in this city are nothing more than iron bridges ten miles long, and the first thing the engine with the flat tire did was to attract universal attention by the noise she made. Then the Swinerton folks said the facets were too long. The engine slipped very badly and it was perfectly plain—after she would slip hard without starting—that she had touched the points between the flat spots only.

The facets have now disappeared from the tread of the wheel, and no difference between that and any other tire can be noticed; still the flat spots can be distinguished by using a straight-edge. The engine has not been able to pull any more cars than the rest, slips just as bad with sand, and worse without, and cannot be declared an improvement or a success.

The company's engine "Onward" has been on the Central of N. J. for some time, and does fairly well, the engineers say that it is because they use the patent sand jet. She has not been able to show a single advantage over other engines, and we will warrant that there is not an 8-wheeler on the road that cannot do as well as she does by taking down the side rods, and putting the same amount of weight on the driving wheels.

The Swinerton driving wheel is an attempt to prove that the amount of surface in contact, instead of the weight or pressure, governs the adhesion of a locomotive driver to the rail. That it should fail to disprove this well-founded law of friction surprises no thinking man—much less a mechanic.

The projectors of the flat facet wheel have never yet satisfactorily explained how the wheel was able to hold to the rail in changing from one flat spot to another, when, according to their own theory, it would have much less adhesion than a round wheel.

On the Ladder.

Three years ago, when the editor of THE LOCOMOTIVE ENGINEER came East to assume that position, he rode from Milwaukee to Chicago on a C., M. & St. P. locomotive, under the charge of engineer James H. Little. This engineer paid very little attention to us, but a good deal of attention to his work, and, consequently, we got to Chicago on time.

About a year afterward the office of traveling engineer was established, and "Jim" was appointed to fill the place, and he has done it so admirably that General Superintendent Earling has just appointed him train master of both divisions of the road out of Chicago. Train master on that road is virtually assistant superintendent.

Railroad managers in the Northwest are beginning to see that practical road men do better in positions of this kind than officers promoted from offices, and better than telegraph operators. Conductors are good, but engineers who have handled the engines and trains are far better, and know what can be done with the power better than any other men on earth.

That good engineers should succeed in places of trust and responsibility like this seems a matter of course. Those who show themselves specially capable of development are the ones who must get the chance when there are places to fill.

As traveling engineer Bro. Little has done a great deal to circulate THE LOCOMOTIVE ENGINEER among the men, and, in a recent letter to the editor on the subject of the work in hand, he said:

"I claim yours is the best mechanical paper published for enginemen, and there is only one improvement I could wish to see, or change to suggest, and that is that you charge $2 per year for it, and make it just twice as large. I hope this change will come in time. I certainly wish it great success and prosperity."

Before another two years has gone by, Jas. H. Little will have written a higher title behind his name than he now has. Ability, energy and common sense keep a man on the ladder once his feet are on the rungs.

A Railroader Gets the Telegraph Prize.

On the 10th of April there was held in this city a national fast telegraphing tournament, at which a large number of experts with the key and sounder took a hand; there was a ladies' class, an old-timers' class, a class *B*, and a free-for all-class *A* for the grand prize, and the championship of America for speed.

The opening address was made by Manager F. Catlin, who, instead of his mouth, used a key and sounder; this brassy speech was well understood by the majority of those present, and rounds of applause greeted each point.

Associated press and other fast senders gathered here to show what they could do, and among the many who stepped upon the platform, there was not a single "plug."

When it came to the final test of speed, and the contestants were pounding out 40 and 45 words a minute it got interesting, until B. R. Pollock, the train dispatcher of the N. Y. & New England road, took his seat—the only railroader in the crowd—and sent 258 words in five minutes. Every one was surprised, and the judges would not decide until Pollock sent 260 words on the third trial, or at the rate of 52 per minute.

Thus does the country railroader come down to the metropolis, capture the big prize and the world's championship, and show the people what men in the ranks are—then go back and hustle "do-nots," and lay the boys out.

J. N. Lauder, Supt. M. P. of the Old Colony road, is building at the South Boston shops a compound locomotive. It will be of the two cylinder style 20 and 29 x 24 The most peculiar feature about it will be the location of the engineer, who will be on the left side; on the Boston & Providence line of this road, the trains run upon the left-hand track, and to change all the signals, switches, etc., would be a great expense, so it is proposed to place the engineer where he can see the signals instead of depending on the fireman to see them; the other engines on this line will also be changed.

Books Received.

SLIDE VALVE GEARS: By Frederic A. Halsey D. Van Nostrand Company, New York Price $1 50.

This little book treats in a masterly way on all the points to be observed in designing slide valve motions It treats almost exclusively on the different forms of valve motion for stationary engines, and is not intended as a treatise on link motion at all. Mathematical formulas are avoided, and all propositions made plain by graphical methods

The author has hit upon a happy idea in making two books in one. There are a number of chapters marked with an asterisk (*), and a beginner can skip these on first reading, the other chapters being elementary and the subject matter continuous, so that young students are not mystified by the use of terms and formulæ they cannot be expected to understand. For those, whose duty it is to design and work out valve motions, this work is invaluable. It is not intended for locomotive engineers

ASKED & ANSWERED.

(26) J. M., Huron, S. D., asks

Which kind of coal can a fireman get the most heat out of—coal that is wet with water or dry coal? I wish you would give a definite answer to this. *A*—You will get more steam from dry coal.

(27) T. D. W., Willard, Tex., writes:

I have charge of a 20x44 Atlas-Corliss engine, running at 70 turns per minute, what horse-power is she? *A*—In order to figure the horse-power we should have to know the steam pressure.

(28) J. W. H., West Superior, Wis., writes:

Please give me a rule for finding the heating surface required in locomotive service per horse-power. I was figuring by your rule the power of the Mason-Farlie engine, and divided the heating surface by the horse-power I could only get, at the most, three square feet to each horse-power Maybe I am wrong, therefore I wish you would set me right. *A*—Your figures are about correct; horse power is not used much in computing power of locomotives, but three square feet of heating surface for one horse-power is a fair average.

(29) E. A. G., Camden, N. J., writes:

1. Please see if my figures for determining weight of load for safety valve are correct 2 Suppose we have a 2" spring, safety valve whose area is 3 1416, pressure 120 pounds, weight of spring and valve 1 pounds, would not the tension of spring have to be compressed so as to be equal by comparison to a dead weight of 372 9920? *A*.—1. Your figures are correct, except that in adding you misplaced the decimal point, getting 159 where you should have but 175.5, and making your answer 58.54 where it should be 63 36. 2 Yes, slightly more, as that weight will just balance the pressure.

(30) W. K. J., Glenn's Ferry, Idado, writes.

In the shop where I am working we are using an old locomotive engine to run the machinery There is a Judson governor on steam pipe, and they are also running the engines with the links out back. Now "A" says that there is no need of hooking links up, as the governor cuts off all steam not needed to run engine. "B" says that, by using governor and running engine with links hooked up, there is a saving of steam or, in other words, is there a saving of steam when using a governor on a link motion engine to run engine with the links hooked up, or cut-off? Which is right? *A*—B is right. By running with links hooked up the engine is using steam expansively—the governor simply maintains uniform speed

(31) E. S. G., Plattsmouth, Neb., sends sketch of a double or balanced throttle having a top $0\frac{1}{4}$" in diameter, and a bottom of $5\frac{3}{4}$", the pressure of the boiler tending to open the lower valve and close the top one, and asks: Will you please let me know in your Answers to Correspondents why a throttle valve like accompanying tracing will work open when using steam? That is, when throttle valve is partially open, it will open of itself *A*—When the double throttle valve is lifted off the seat, the area of the top valve is decreased to the size of the opening under it, which is but $5\frac{3}{4}$, and the steam passing between the seat and the valve tends to lift it Of course all the pressure on the lower valve tends to open; the pressure on the throttle stem is, of course, some, but this is probably more than overcome by the friction of the packing

(32) E. H. P., East St. Louis, asks.

1. If I break a back-up eccentric strap, can I bolt the blade of the back-up to the go-ahead eccentric blade, and take in my full train? 2. My injector won't work, my pump wont shu't off, I am running 25 miles per hour, and must make the next station for the fast mail, what shall I do? I now have three gauges of water 3 What is the proper way to key up rods on a pony? 4. Where can I get a good explanation of valve motion? *A*.—1 No 2. Put on your heater hard enough to prevent the pump getting water by driving it out of the feed pipe 3. If your pony is 4-wheeled connected, put her on the center, key your main rod, and then the side rods, do not key the rods close; side rods should be so easy on pins that they can be easily shaken, but the brasses should be tight in the strap, and keyed brass to brass; be careful not to drive the keys hard enough to spring the brass; if a 6-wheeled engine, key the main connection of side rod first. 4. Sinclair or Forney give detailed explanation of link motion in their books. Alexander's Ready Reference has a plate and short explanation that is very plain. You can find out about extension of the road you mention by addressing some official of the company

(33) L. T., Alexandria, Va., writes

I wish you to enlighten me on the following question in regard to the air-brake. If I understand it right, the air in the train pipe controls the triple valve What I want to know is this: If the air gauge indicates 80 pounds, and you draw 20 pounds off the train pipe, which air from the train pipe escapes in the atmosphere, the air in the auxiliary rushes in the brake cylinder and applies the brake? Now if 20 pounds reduction allows the triple valve its full opening, isn't the brake applied with 80 pounds pressure from the auxiliary? I had an argument with one of our men, who claims that the brake is only applied with 60 pounds pressure; that taking 20 from 80 only leaves 60 pounds for the brake My understanding is, the 20 pounds reduction from the train pipe allows the 80 pounds pressure in the auxiliary to apply the brake. The 20 pounds reduction is from the train pipe, not the auxiliary, which leaves 80 pounds in auxiliary to apply the brake Am I right? *A* You are both wrong The reduction of pressure in the train pipe does not affect the pressure in the auxiliary drum but the air stored there at 80 pounds pressure is obliged to expand into the brake cylinder and in doing so loses a large per cent of its pressure In reducing the pressure in the train pipe to the degree you speak of by service stop, the triple valve does not allow the air in auxiliary drums to rush into brake cylinders full head—it has to pass a very small valve in the slide valve of the triple, and this valve is closed by a spring as soon as the air in the auxiliary is reduced nearly to the pressure in the train pipe, so that, instead of 60 pounds being applied to the brake, there would be nearer 25. The full pressure is only applied in an emergency stop, or when air is nearly all exhausted from train pipe quickly

(34) John Bruce, Ellis, Kan., writes:

1 Will you please let me know through the columns of your paper how to find the radius of the links on an engine? What is the rule, say you had nothing but the links, they being a portion of a circle, is there any rule by which you could determine without taking a point for center, and changing until it would make a circle, which these links are a part of? Is there any difference in long eccentric blades and short ones, in the working of an engine? I heard a runner say he often had to hook the long ones up when running down hill when shut off, as they would tear things up about the valve motion, or run hot if run far. 3. How can I find the stroke of valve and throw of eccentric, and what is the travel of the valve at different points of cut off? *A*.—1. The radius of a link is determined by the distance between the axle center and center of rocker, there is no better or quicker way to find the radius than this, and no necessity for one. 2. Some valve motions jerk so badly when running fast, shut off, that it is better to hook up links some; but this is not always caused by long or short rods—In hooking up you do not shorten the throw of the eccentrics, but the travel of the valve; you allow the eccentrics to move the ends of the link the same, but take off part of the movement of the valve—most of the trouble is there 3. By measuring, if the rocker arms are of equal lengths the travel of the valve is equal to the throw of the eccentric; the throw of the eccentric is the easiest found by subtracting the low side from the high, the remainder being the throw, the distance from the center of the shaft to the center of the eccentric is half the throw Find travel of valve at different cut-off points by measurement

(35) T. J. H., San Bernardino, Cal., writes

1. We will suppose a pressure cock to retain exactly 20 pounds of air in brake cylinder, and engineer, wishing to set brakes tighter, exhausts from train pipe say 5 pounds of air Now how is 5 pounds going to go in brake cylinder against the 20 pounds already in there and make a total of 25 pounds, or will it be necessary to exhaust 25 pounds from train pipe in order to get an extra 5 pounds added to the twenty pounds already in cylinder? 2. Take a brake cylinder 8" diameter with 60 pounds per square inch exerted on piston which moves from cylinder head exactly 1" (we will imagine the cylinder has no leakage groove); this will give a braking power equal to the square of diameter multiplied by pressure per square inch, which equals 3,840 pounds braking power. Now if piston is moved 5" from cylinder head, will you have five times the braking you had in first place or not? 3 Why is saddle pin on link placed back of the perpendicular center of the link? Is there any advantage? If so, what is it? *A*—1. When a pressure-retaining valve is used it does not stop the functions of the triple valve, but simply plugs up the exhaust; when there is a certain pressure left in the brake cylinder the auxiliary is charged again, as usual, and the brake can be used the same as in service. A reduction of 5 pounds in the train pipe will put much more than 5 pounds pressure into the brake cylinder; in this case there is, say, 70 pounds in the auxiliary, and this is turned against the 20 in the brake cylinder, and flows into the brake cylinder until it decreases the pressure behind the piston of the triple valve enough so that the pressure in the train pipe can close it against the pressure in the auxiliary While the pressure-retaining valve is on, the slide valve can be moved to re-charge the auxiliaries without letting off the brake or having the 20 pounds of air have any influence on the triple valve whatever 2 There is just as much pressure on a brake piston at 1 inch from the head as at 5 inches; it is a matter of area 3. Saddle pin is placed back of the link center to equalize the cut-off distorted by the angularity of the connecting rod. See October and November numbers of 1889

Central Railroad of Georgia.

[Editorial Correspondence.]

It is pretty hard to find a place of any size in Central Georgia or Alabama where the trains of the Central Railroad and Banking Co. will not take you, and the concern controls so many roads that it is hardly safe to attempt to enumerate their equipment There are, however, 1,140 miles of road in the main system, this being made up of numerous short lines running in every direction, instead of in a trunk or continuous line

There are 150 locomotives in the service, and 2,300 cars—the company owning and operating their own sleepers This company control the Ocean Steamship Co., and run a line of steamships to New York, Boston and Philadelphia.

The Central Railroad of Georgia is one of the oldest Southern roads, having been chartered in 1835, and the charter of the old Macon & Western, now a part of the system, dates back to 1833, and the main lines of the road have been in successful operation since early in the 40's

The main offices and shops are at Savannah, Ga., where are also the extensive docks of the steamship line

The property of the company is surrounded by a massive brick wall, and the buildings, offices, shops, etc., are put up to stay; there is but very little that shows a temporary arrangement was intended. Brick walks are laid, and heavy walls of brick abound in all the works. We noticed a long-bedded timber planer outside the wood shop, this planer was, perhaps, 30 feet long, and was covered by a canopy roof as long, and some eight or ten feet wide, the brick pillars supporting this roof were about 18x36 inches.

The motive power of the system is under the care of Mr. T. L. Chapman, and the Savannah shops are under the immediate charge of F. H. McGee, Division M M , who was an engineer on the road.

This shop has to do a great deal of the heavy repairs of the ocean ships, and have some heavy machinery for the purpose, but, as a rule, the shop has not much or very modern machinery, and the tool-room is small and gingerly supplied. But the work is well divided up, and the machinery does not make a big display

They have a unique roundhouse, the very best thing of the kind for their climate, but not at all adapted to the blizzard section of the country This house is a complete circle, with the outer wall of brick, on top of this wall the roof is raised up about six inches, for ventilation, and the inner edge of the roof is supported on light pillars set some distance from the inside edge of the roof; there is no attempt at a wall or any enclosure from the inside Of course this makes a very light place to work in, and is cool. There is no need of smoke-jacks, for the smoke and steam have only to follow the shed roof—which is of iron—to escape to the atmosphere It has not snowed in Savannah since 1858.

The only wooden building about the place is the paint shops. The cars have always been red, like the Pennsylvania, but the color is being changed to the dark color used on Pullman sleepers.

Janney couplers are used on passenger, and the Thurmond on new freight equipment.

In the yard there was a large pile of car wheels made in contracting chills; these wheels showed a sharp burr on the face of the thread at every segment block, some of these were as much as $\frac{1}{16}$ of an inch thick at the tread, and from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch high. Of course such work is condemned and refused, and it is hard to imagine what kind of a wheel maker would think that it would do at all. The teeth are too light for gearing, and too heavy for car wheels

The sleepers of this company are of their own build, and are very much like the older Pullmans, but they have one improvement over Pullman, and that is that, when the upper berth is not taken, it is left up

The motive power is good, most of the locomotives being new, and of modern build. Many of the moguls have a "squeeze" brake on the back pair of wheels, a shoe each side of the wheel, brake operated either by steam or vacuum. This scheme may have some advantage in fewer parts, but it must be hard on the side rods.

There are a few old engines in service yet, most of them wood burners, but they are fast going to the wall

Moguls and ten-wheelers are their heaviest engines. Consolidations have not yet made their appearance

For engine trucks they use a heavy wrought-iron framed truck, with outside journal boxes; this is called the Wadley truck, being the design of a former president by that name. The springs are half elliptic, and lie across the truck instead of over or between the boxes. The original design was a swing truck, but trouble was experienced with it, and stops were put each side of the center casting, virtually making a rigid truck of it. By giving this center an inch or so of side play, the center can be shifted by dropping blocks of different thicknesses between the casting and the stops, thus allowing a chance to obviate the evils of flange cutting.

It is claimed that this truck is cheaper than the ordinary truck, is easier to get at and repair, has fewer pieces, and runs a very long time without attention; yet it is not being put under new engines.

There is an extensive brass foundry here, where all the brass and bronze work for the system is done, about 8,000 pounds being melted daily.

There are quite extensive shops at Macon, the grounds and yard being ample as well as the buildings, which are good and substantial; but the shops are poorly supplied with machine tools.

The erecting shop is an old roundhouse entirely enclosed, the immense roof being plastered. It is difficult to clean, as water from a hose cannot be used on it, it is, therefore, jet black. There was considerable work on hand, and several engines in undergoing general repairs. We noticed one getting a very large and expensive patch on the right cylinder There were also several old wood-burners getting changed to coal-burners.

While the machine shop is only average, the blacksmith shop is an extra good one, fires, forges and hammers are arranged in what seems the very best shape, everything is served by cranes, and more special rigs, dies and such tools are in use than in the rest of the entire plant.

These shops are admirably located for the general shops of the road, being nearly in the center of the system, and will, in all probabilty, eventually become such.

The repair track here was full of broken freight cars, like the yard of every road we saw in the South, which shows the cost of breaking in two, and rear-end collisions. It seemed as if we saw enough wreckage on this one trip to pay for the equipment of a large part of the rolling stock with automatic brakes.

There is here a large roundhouse, but it was receiving a new roof, the old iron one having rusted out.

D. M. Gugel, who has been in charge here as M. M. for some thirty years, has just resigned, and Mr. C. F. Thomas, of the E. T , V. & G., appointed to fill his place.

In the Savannah shops it is very hard to prevent the engines, tools and work from rusting; new work will rust in a night on the benches, and paint and oil only seem to lessen, without curing it.

Your representative came to New York from Savannah on the steamship "Chattahoochee," one of the fleet of this company. She weighs 2,076 tons. Some idea of this weight can be had by thinking of fifty-three fifty-ton locomotives in a row She has a compound engine with a high-pressure cylinder, 38x54 inches, and a low-pressure cylinder 74x54 inches, both cylinders being of the same length; ninety pounds of steam is carried. Her coal bunkers hold 204 tons. It is about 750 miles from Savannah to New York by sea, but after we got out of sight of land it commenced to blow, and, if the distance that the boat made *up and down* were stretched out in miles, she would have reached the North Pole instead of Sandy Hook

Unbraked Wheels and Efficient Braking

In another article we have given the facts which show how the Lake Shore accident did happen. It may be of interest to consider a little how it *might* have happened, and how any train running without all the wheels of the cars braked, and with the cars in the rear least effectively braked, is exposed to the same sort of accident. Until the fact was established that in this accident there was no failure of the brakes to hold the rear cars, this inquiry had an immediate interest, which, fortunately, it has lost, now that more of the facts are known. Nevertheless, the moral is still applicable.

In the ill-fated train the weights, braked and unbraked, were about as follows :

FRONT SECTION

	Total weight, lbs	Braked weight, lbs
Locomotive .	110,000	55,000
Tender .	50,000	25,000
Four baggage and express cars .	160,000	144,000
Two day coaches ..	100,000	90,000
Total.... . ..	420,000	314,000

The braked weight was approximately 76 per cent. of the total.

REAR SECTION.

Five Wagner cars..	400,000	240,000

The braked weight was approximately 60 per cent. of the total. These weights are not given as absolutely correct, but we think they will be found very close approximations. It is hardly necessary to say that the difference in the percentage of braked weight of the two parts of the train comes from the fact that but eight wheels out of twelve on each of the four Wagner cars were braked.

Now, had the automatic brakes on all of the cars been operative, what would have happened when the breakaway occurred? The engine, relieved of part of the load, would for an instant have speeded up and made an interval between the two parts of the train before the effect of the brakes was fully felt. This is well known to be what actually happens, even with the quick-acting automatic brake. Then if both parts of the train were equally well braked, they would retain this interval when they stopped. In the exhibition of tests of the Westinghouse train, in the fall of 1887, the distance apart of the sections, when stopped, ran from 22 to 61 feet, and averaged 50 feet. Were the speed high enough to materially lessen the coefficient of friction this interval would be increased. In the case of the Lake Shore train the sections would have separated perhaps 50 feet, perhaps more or perhaps less Then, when the full effect of the brakes was felt, the rate of retardation of the front part, with 75 per cent. of its weight braked, would have been greater than that of the rear part with 60 per cent. braked; and we can readily understand that the first section would have come to a stand first, and a collision ensued, or that the difference in speed of the two sections would have been sufficient to cause a serious wreck

One of the older railroad papers, of recent date, has the above, which we think open to argument.

In the train brake tests cited, the opening between the broken sections occurred principally because the retarding power of the brakes on the rear portion was greater than that of the forward portion, augmented by the fact that the locomotive exerted some pull upon forward part of train, but the main reason being that the locomotive was not braked in proportion to its weight. Where a fully braked train is broken in two an opening is usual, but where the rear of train has cars not braked an opening is not usual—this is proven in practice.

With a freight train of 31 cars, 21 of which had automatic brakes (old-style and quick-action mixed), and running 25 to 30 miles per hour, the writer saw the pin pulled and train parted at the thirteenth car from the rear, this left the rear portion with thirteen loads braked only by three cars, while the forward section had eighteen loads all braked, and the locomotive (not braked); an opening of about thirty-six inches occurred before the hose parted and the brake applied; the rear part of train did not get so far behind the forward part that men could not jump from one car to another, and it gradually closed up without dangerous shock, and the brakes on the forward part of train had to stop the rear part, just as they would have done if the cars had been coupled together. In actual freight service on the Western roads this is occurring all the time with no bad effect, as the brakes being ahead do not allow great enough opening between the sections to cause damage, when the rear section is fully braked it cannot keep up; when it is not fully braked it does keep up, and serious shock does not occur.

Twelve-wheeled cars, with only eight wheels braked, do not allow a train to be stopped quick enough in an emergency, that is a fault. If all this would point to any needed improvement it is to the desirability of braking the locomotive as fully as possible for service, and not emergency.

Worse and Worse.

The *Northwestern Mechanic* has the following explanation (?) of the air-brakes. For getting everything dead wrong, and inventing new forms of brake appliances, it takes first money :

A. L. D , Hudson, Wis , asks: Will you please explain the working of the Westinghouse air brake, also the difference between "straight" and "automatic" air ?

A. As we understand the matter, the Westinghouse brakes are set by springs, and let off by pumping a partial vacuum into the reservoir, thus pulling brakes away from the car wheel. Have not been able to find the exact technical meaning of "straight" and automatic air, but presume the former term is used when air is applied by engineer, the latter when train breaks, thus setting the brakes.

Wonder where they get the vacuum to pump into the reservoir ?

Pedrick & Ayer, of Philadelphia, write us to say that, in view of the orders now on hand, they have decided to place the price of their valve motion model at $70, net.

The Baldwin Works' Compound Locomotive.

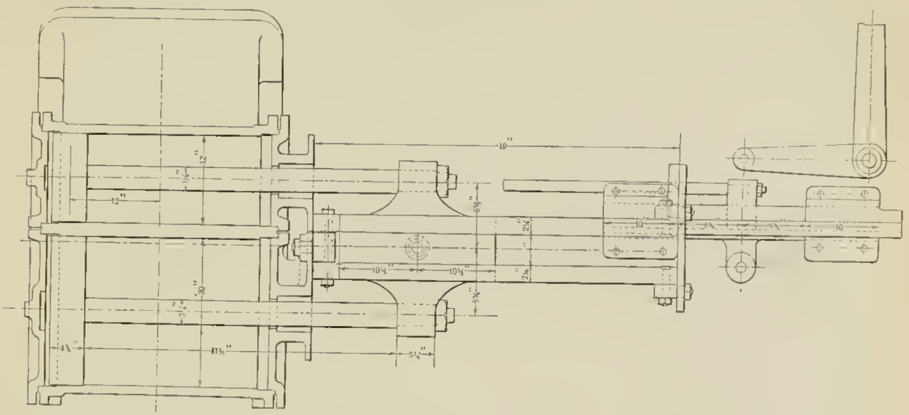
We regret very much that the delay in receiving blue prints prevents us from showing detail cuts of the Baldwin Compound Locomotive on the B. & O road. The cylinders, guides and arrangement for moving the valve, is all we can show.

This engine was built under the patents owned by the works, and was designed to provide a cheap and efficient method of compounding the ordinary locomotive. They use two cylinders on a side, placed one above the other, one 20, the other 12 inches in diameter, and steam is admitted to both through an ingenious double piston valve, located beside the high-pressure cylinder.

Both pistons are fast to a common crosshead, and instead of a rocker the links move a block on a slide—a very simple arrangement.

By this arrangement of parts, very short steam ports are secured, and a receiver is not needed.

The arrangement of guides and crossheads calls for an increased outlay, viz., the cost of two more pistons and their fittings. These are small and comparatively inexpensive. The stuffing-boxes, being fitted with metallic packings, are not serious matters of cost or maintenance. The casting, comprising the cylinder, steam-chest and half-saddle, is of about the same weight as that used on the ordinary locomotive, the exact weight on the truck



of this engine being but 25 pounds more than the ordinary locomotives of the same class, and in every other way is its counterpart. In the connection of two pistons to a common crosshead, the most satisfactory results have ensued. The guide bars and guide bearer are very light, and no heating, cutting or bending has been noticeable in some 20,000 miles of service. A spoonful of oil is sufficient to lubricate them during a run of 100 miles.

All other parts are similar to those of an ordinary locomotive of the same class, not compounded.

The facility with which the engine starts depends upon the admission of steam to the low-pressure cylinder, which is readily accomplished by coupling the two ends of the high-pressure cylinder, and wire-drawing into the low-pressure cylinder. A pressure can thus be obtained, sufficient to start the heaviest trains, utilizing the entire adhesion of the engine without undue strains on the piston rods.

Water caused by condensation in cylinders, the enemy of compound engines in general, is felt to a very slight extent only, so much so that no cylinder cocks are required for the high-pressure cylinders, and one or two strokes clear the low-pressure cylinders entirely.

Relief valves are provided on the low-pressure cylinders to prevent damage in case a careless engineer should get the boiler too full of water, and work it over into the cylinders.

Heavy freight trains, as well as fast express trains, have been hauled with equal success. A piston speed of 1,500 feet per minute has been attained in express service.

As this locomotive has been developed and improved during the past six months, the Baldwin Locomotive Works are now in a position to proceed with accurate tests; comparisons will be made between the compound and the ordinary locomotives of the same class built from the same drawings in all other respects.

The economy in actual practice is so apparent with the locomotive, that an economy of at least 25 per cent. of fuel is expected, and little or no more repairs, while engine is in service, than would be required by an ordinary locomotive.

Some of the papers announce the order of several duplicates of the "J. W. Miller," on the Stonington road, to haul the fast trains there. As a matter of fact, the new engines are about as different from the noted "Miller" as they well could be designed. The "Miller" was designed for hard coal, was 18x24, had a two-inch steam port, two-inch lap and seven-inch travel. The new ones are for soft coal, have deep fire-boxes, 1¼" ports and a reasonable lap and travel. Engines like the "Miller" only come one in a crate

The Homestead Steel Works.

On the 17th of April, Carnegie, Phipps & Co., Limited, through their railroad agents, Coolbaugh McMunn & Pomeroy, of this city, ran a special train to Pittsburgh, to enable a large party of motive power officials to inspect these works, and see how the modern processes admit of the production of boiler plate of uniform quality at the prevailing prices.

The party was under the personal care of Messrs. Coolbaugh and Pomeroy, and consisted of some thirty gentlemen—besides three editors.

On arriving at Pittsburgh the party were met by the officers of the company and escorted to the dining room of the station, where a breakfast awaited them; after breakfast a special train took the party to the Homestead Works, these works are given up entirely to the manufacture of steel plate and structural iron. This plant is new; all the buildings, machinery and processes are modern, and the party were more than interested in the processes until 12 o'clock, when they put their knees under a well-spread board at the hotel of the works

In the afternoon the party were taken to the Edgar Thompson Steel Works, where a specialty is made of steel rail.

This mill is the largest and finest in the country, and produces more rails than any other plant. The work of handling is done almost entirely by machinery, it being almost impossible to follow a bloom from the furnace to the cooling shed, where it comes out a completed rail.

The rails come to the cut off saws in lengths of a little over 60 or 90 feet, and are there cut into 30 foot rails.

We hope at an early day to be able to present a description of these works, and enumerate the figures representing their output

The principal dimensions of the Homestead Mills are given below, and were furnished by the works; the rail mills being larger, will show much greater capacity.

The Homestead Steel Works are located some nine miles above Pittsburgh. They are on the lines of the Monongahela Division of the Pennsylvania Railroad, and the Pittsburgh, McKeesport & Youghiogheny Railroad. The property consists of some 89 acres, of which the works proper occupy about 50 acres of level ground, having a river frontage of 3,100 feet.

The Bessemer department comprises a converting mill 119x73 feet, in which are located six melting cupolas, and two five-ton converters; a blooming mill 178x73 feet containing soaking pits; a powerful blooming train and hydraulic crane for handling ingots, etc., also structural mills 33 inches and 23 inches, which are in a different building, 602x84 feet, having three wings 80 feet deep. In this building there is a 10 inch train for rolling spring steel, rivet rods, etc. The two structural mills are devoted exclusively to rolling steel beams, channels, angles and tees.

The open-hearth furnaces, plate train and finishing machinery are housed in the same building. This is 967 feet long, and is constructed entirely of iron and steel The main building, containing open-hearth plant and plate train—a 119 inch mill, the largest in the world—is 501 feet long, and 86 feet wide in the main span, with a 45 foot wing on each side. The inspecting and marking-out department is 273x43 feet, and the shearing department is 187x86 feet. The open-hearth furnaces are eight in number, a new building is now nearly completed, however, which will contain eight more open-hearth furnaces. This building is about 400 feet long by 200 feet wide.

The furnaces all use natural gas as a fuel, the stacks being placed at the back, and the checker work in the flues pre-heating the air. Charging is done from the general floor level. These furnaces are arranged in pairs, with casting pits between each pair. Nos. 2, 3 and 4 are opposite Nos. 7, 6 and 5 respectively. Between the pairs of furnaces are the ladle cranes, which are directly in the center of the building, and on either side of the cranes are semi-circular pits, capable of taking four sets of moulds. Each pair of furnaces is attended at pits by two seven-ton and two twenty-ton hydraulic cranes, which command the furnace itself, the casting and ladle pits, and the narrow gauge tracks by which the product of the furnaces is removed. At one end of the open-hearth department is a small steel foundry, where special castings for use in the works are manufactured.

The capacity of the open-hearth plant amounts to 7,500 tons of steel per month. This output will be doubled when the new addition is completed.

The slabbing mill is constructed of steel and iron, and is 300 feet long by 120 feet wide, with a 35 foot wing for boilers. Eight heating furnaces and vertical pits 6 feet in diameter and 7 feet deep, are arranged in pairs in the northern end of the building. Two 35-ton hydraulic cranes, fitted with simple hydraulic tackle for gripping ingots, charge and draw these furnaces.

The slabbing train itself is a universal mill. The vertical rolls are of steel 20 inches in diameter, and are driven 50 revolutions per minute, by a pair of 30x54 inch reversing engines, running 100 revolutions per minute. The horizontal rolls are 33 inches in diameter, and are driven by a pair of 40x54 inch reversing engines. This train has already dealt with 48 inch by 48 inch ingots, weighing 38,000 pounds, and is capable of taking a 25 ton ingot 48 inches by 54 inches, and rolling to a section 11 inches by 3 inches. Tables carry the ingot from the roll train to the shear. Tables on both sides of the rolls are run by a pair of upright 10x12 inch reversing engines, and the shear table by a pair of horizontal 8 inch by 10 inch reversing engines. Besides the two cranes for handling ingots at the pits, there are in the mill two sixteen-ton and seven five-ton slab cranes.

The shear power is hydraulic, and operated by the descent of the upper knife with a pressure of 4,000 pounds per square inch (given by two pressure pumps, 65 inch steam cylinder, 10 inch water cylinder, and 8 inch stroke). The shear develops somewhat over 3,000 tons power, and is capable of shearing a 48 inch by 24 inch section. A general pressure in the piping throughout the mill of 500 pounds per square inch is supplied.

All slabs from this mill, before being shipped away or sent to the plate mill, are subjected to a thorough inspection.

In many plate mills the ingots are cast flat, and then rolled down into plate, but here the ingots are cast in the regular large square shape, and are then slabbed down at right angles into thick flat slabs, when they are re-heated and then rolled into plate wide, and can handle plates as high as six tons in weight. Its capacity is 5,000 net tons per month.

In connection with the plate mill is a special set of rolls for bending plates and beams, capable of bending the largest plate that can be rolled in the mill. This department has testing apparatus, and a chemical laboratory.

The system of inspection at these mills is very thorough. The government keeps several inspectors there all of the time, and both by these and the regular inspectors, each plate is inspected both visually and chemically. A record running back for years is kept of every slab, so that the heat, constituents, and everything about it can be told in a very short time.

The shipping department is supplied with sixteen cranes, which place the plates directly on cars on side tracks.

The yard service of the works is performed by three standard gauge engines, and six narrow gauge engines of various sizes. There are nine miles of railroad tracks in the works. In addition to a number of hand and hydraulic cranes in the various shipping departments, there are four 10,000 pound, and two 5,000 pound locomotive cranes.

The yearly pay-roll amounts to approximately $2,000,000, and the number of men employed is about 2,500.

During the visit of the party, the rolls were busy on armor plate for the battle-ship "Texas."

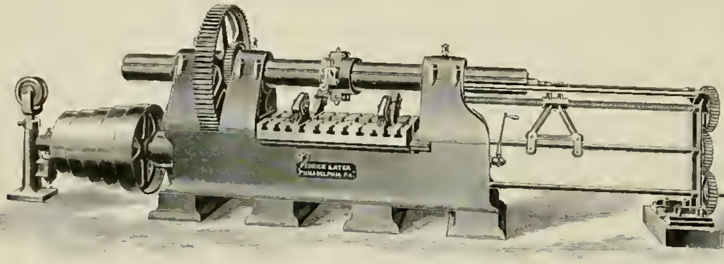
Two hours of the evening were very pleasantly spent in the dining-hall of the Duquesne Club, the entertained shook the hands of the entertainers, and the special train pulled out of the depot for New York.

Each and every member of the party expressed himself as having learned something concerning the manufacture of modern boiler plate, and in the learning a great many hobby-horses and theories got knocked down.

them complete with flanges faced and turned in less than seven hours each; this is very rapid work when the composition of metal for cylinders is considered. They are made of 2,600 pounds of old car wheels, chill and all, tempered with 800 pounds of No 1 charcoal iron, making a very hard, close mixture. With ordinary iron that is often used, the time can be reduced very materially. They do not use facing arms, but place a side tool in regular cutter head, and face off with that.

This machine has just been placed on the market by Pedrick & Ayer, of Philadelphia.

On the 6th of April there was a very largely attended union meeting of train and enginemen at Elmira, New York. The meeting was held under the auspices of Liberty Lodge, No. 242, B. of L. F., and an attendance of over 500 railroad men was the result. The meeting was held with the special object of harmonizing the orders and teaching the true principles of federation. Secret sessions of the different orders were held in the forenoon, and in the evening a public meeting was held at the Opera House. The grand officers of the several orders made speeches, and the whole meeting was interesting and instructive. On the evening of the 7th, a grand ball was given as a fitting wind-up. We have to thank the management of this meeting for a very handsome programme, in the shape of an embroidered harp. This kind of a holiday makes men better satisfied with their lot in life, helps educate them, broadens their views, and teaches the reason and justice and power of fraternity.



in the usual way. This double process increases the strength of the plate, making it more thoroughly wrought and tougher. The high requirements of the government, for whom the firm makes more steel plate than any other, made this extra thoroughness of work and material necessary. The capacity of this mill is 10,000 tons per month.

PLATE MILL.

Ingots were formerly roughed and finished in this mill, but are now roughed in the universal mill to slabs, which are brought by small cars directly to the heating furnaces of this mill. Three heating furnaces, 25 feet by 6 feet 9 inches, are located on each side of the mill, charging and drawing being done by a special hydraulic crane controlled by one man, who is carried about on a seat suspended from the gib.

Re-heated slabs are placed by these cranes on a table of live rollers, which carry them to the mill. The mill is —— feet high. The top and bottom rolls being 119 inches long and 32 inches diameter, and the middle roll 119 inches long and 22 inches diameter, making fifty revolutions per minute. A 42 inch by 54 inch horizontal engine drives the roll train, and screwing down is done by means of a small vertical engine.

From the rolls the finished plates come slowly down a roller table 363 feet long and 5 feet 1½ inches wide, driven by a line shaft and a bevel gearing. An overhead traveling crane runs the full length of the table, so that the plate can be removed at any point, turned over for the inspector on the lower side, or shifted to any part of the table or floor as may be desired. On this the plates are allowed to cool, air having free access below the table, and are inspected above and below, and stamped as to the quality, dimensions, etc , and carefully laid out for shearing. The inspectors examine stamping and marks, and stamp test pieces. From the table plates are rolled on casters to the shears. The casters are small rolls supported on vertical shafts fixed in the floor. The shearing is done by three shears, one with a knife 135 inches long, and two 36 inch knives.

This mill has rolled plates from 3 inches thick, 115 inches wide down to ⅜ inch thick and 117 inches

Leeds' Cylinder Boring and Facing Machine.

The machine here shown was designed by Pulaski Leeds, Sup't of M P. of the L. & N. Railway, for boring and facing locomotive cylinders.

The machine is extra heavy and strong, as will be seen from the engraving. There is not the least tremble or jar on the heaviest work, the bar being 8 inches in diameter, and the bed and housings proportionately heavy. The bar is driven by powerful gears, 4½-inch and 5-inch face, back-geared 36 to 1, and driven by a 5-inch belt on cones, the largest of which is 30 inches diameter, and smallest 18 inches in diameter, with five changes. The feed is changeable by placing change gears similar to lathes for cutting screws. Distance between bearings for bar to revolve in is 4 feet 6 inches, but can be made to meet any requirements.

Table or platen is 36 inches long, with suitable T slots for securing the work. From top of platen to center of bar is 17¼ inches. At the end of the machine, forming a part of cone shaft support, is a sheave to take the weight of bar when drawn out to place cylinder on platen. The table or platen has a sufficient amount of adjustment, and is operated by a screw 2¼ inches in diameter, by a crank from either front or rear end of the machine. When desired, four adjustable saddles to receive cylinders are furnished, which have movable parts, operated by screws and wrench to facilitate placing cylinders in position for boring. When once set machine is all right for other cylinders of same size

At the Louisville shops of the Louisville & Nashville R. R. Co., this machine has been in practical operation for some time, boring 20-inch cylinders 33¼ inches long, counterbore 2⅜ inches long, finishing

E. M. Roberts, who has been for some years master mechanic of the Ashland Coal and Iron Company, at Ashland, Ky., has been appointed master mechanic of the Georgia Division of the E. T , V. & G., at Atlanta, taking the place of C. F. Thomas, who has gone to the Georgia Central. Mr. Roberts is a young man who has already made his mark in the railroad world.

Many heavy locomotives are now being built at an average cost of about six cents per pound—cheap enough.

This has been a hard winter on steam heater men.

GEO. WESTINGHOUSE, JR., PRESIDENT. T. W. WELSH, SUPT. JOHN CALDWELL, TREASURER. W. W. CARD, SECRETARY. H. H. WESTINGHOUSE, GENERAL MANAGER.

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WESTINGHOUSE AUTOMATIC BRAKE.

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GENERAL OFFICE, ST. LOUIS, MO., U. S. A.

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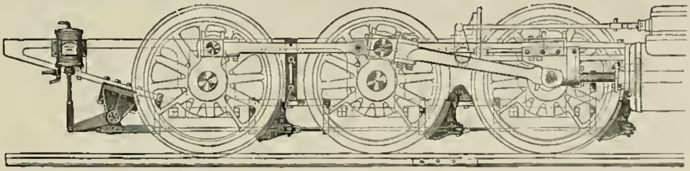

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For Steam or Gas Pipes, Bolts, Screws, Etc.

Far Better and Cheaper than Red Lead.

Makes a tighter joint than red lead, that can be opened with perfect ease many years after.

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BROKEN PIPES, STRAINED TONGS or LEAKY JOINTS.

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JOSEPH DIXON CRUCIBLE CO.,

JERSEY CITY, N. J.

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Specially adapted for use on

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A POSITIVE FORCE FEED WITH PERFECT REGULATION.

Pressure on Grease can be instantly released by hand, without wrenches or screws. Engineer can see at a glance whether Feed is on or off. Tested on locomotive crank pins in hard daily service.

In regular use on the Erie & Wyoming Valley R. R. (with but one filling each week), the Suburban Rapid Transit R. R. (N. Y. City), and other roads.

Our "Lackawanna" Compound, specially recommended for these cups, is not affected by heat or cold, having worked successfully at 30° below, and 95° above zero.

LACKAWANNA LUBRICATING CO.,

SCRANTON PA.

THE SHACKLETON SYSTEM

— OF —

HEATING PASSENGER CARS.

THIS SYSTEM utilizes the live or exhaust steam from the locomotive. Steam is conducted through the cars by pipes placed under the roof. Vertical pipes connect the overhead steam pipe with branch pipes that extend through the large water pipes at the floor level, and heat the water in these floor level pipes.

These large pipes are connected at either end of the car diagonally with radiators. Vertical steam pipes also connect the radiators with the overhead pipes.

The surplus water being drawn up into a reservoir that is exhausted by steam is utilized in the closets.

Under the car, or at one end, is placed a boiler for use in heating the water when the car is detached. With this system there is no drip. Pipes are quickly drained; perfect ventilation; uniform heating of all the cars in a train, entire safety.

The Shackleton Car Heating and Ventilating Co.,

JOS. SHACKLETON, M. E. Gen. Mgr.

BOUND BROOK, N. J.

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BELLEVILLE, ESSEX COUNTY, NEW JERSEY.

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WITH ADJUSTABLE TUBE.

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Uses warm water, avoiding injury, and facilitates raising of steam.

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RUE MANUFACTURING CO., 116 N. 9th Street, Philadelphia, Pa.

THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 6. NEW YORK, JUNE, 1890. $1.00 per Year or 10c. a copy.

Historical Locomotives—The Grasshoppers.

There are very few railroad men who have not heard of the famous "Grasshopper" locomotives on the Baltimore & Ohio Railroad, but few of them have ever seen one. They have, however, been in use longer than any other locomotives ever built—some of them having been in the service more than fifty years—and still pegging away.

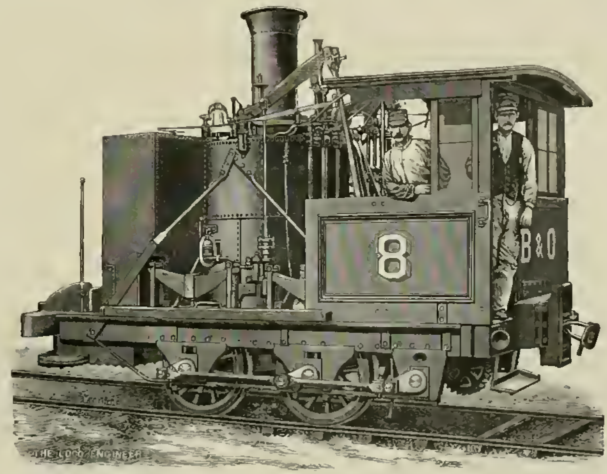
The B. & O. offered a prize, in 1831, of $4,000 for the most approved engine to be delivered before June 1st, 1831, and $3,500 for the next best. The specification read as follows:

"The engine, when in operation, must not exceed three and a half tons weight, and must, on a level road, be capable of drawing day by day fifteen tons, inclusive of the weight of the wagons, fifteen miles per hour."

The firm of Davis & Gartner, York, Pa., furnished for this trial the first "Grasshopper" locomotive, named the "York." It was designed by Phineas Davis, a watchmaker by trade. As you will see, the upright cylinders were placed close to the boiler, and the cross-head was connected to the walking-beam by double connecting rods, and from the ends of the beams rods were connected to cranks on the crank-shaft, and the power transmitted from that to the drives by connecting rods. The walking-beams were hinged on top of the boiler, and their peculiar motion—resembling the motion of the rear legs of a grasshopper—gave them their name; men on the road used to call their running "walking." The original Grasshoppers had a rotary fan to urge the fire, and the exhaust was into the atmosphere.

This picture was made from a photograph taken about five years ago in the yard at Wilmington, Del., and now in the possession of Wm. Wright, general foreman of the P. W & B. shops there. It shows just how the Grasshoppers of to-day look—for there are quite a number of them still at work; the above subject herself still switches at Mount Clare shops, near Baltimore.

An English syndicate recently offered $4,000,000 for the Baldwin Locomotive Works. The works are well worth three times that amount.



THE GRASSHOPPER LOCOMOTIVE.

Two of a Kind.

It is worth notice that the very engineers that kick the hardest, and ridicule the most, and condemn the "machinist runner" the loudest, are the very roosters that think they can file rod brasses, reduce eccentric straps, and line up guides better than any machinist alive. "Machinist runners" do not do road work as well as men with road experience, and are just as poor men for engineers as "engineer machinists" are for repairs and general shop work. What both ought to do is to know what the other needs, but not how to do the other's work. If more machinists could recognize the fact that locomotives ought to be put up so as to stand hard usage at full capacity for twenty-four hours at a stretch, with the engineer caring for nothing but to use the engine to make time, and more engineers could be made to recognize the fact that the joints of a locomotive should be loose ones, that the machinists know enough to close up eccentrics straps so as to be loose at the right place, and that they should be able to adjust wedges, rods and valve motion better than any engineer, the better it will be. Six weeks of firing for the aspirant of the title of "machinist runner," and six weeks as helper for the engineer who knows so much about repairs will cure the most aggravated case.

The R. I. Locomotive Works are building three compounds for one of the Brooklyn elevated roads.

The Longest Lay-off.

It is no uncommon thing for enginemen to get a lay-off of from ten to ninety days for sins of commission or omission. Some of the eastern roads,—notably the Pennsylvania—give very long suspensions, where other roads would fire a man bodily, and sue him for trespass if he walked across the right of way. There is to-day an engineer running out of the city of Philadelphia, on one of the P. R. R. lines, who was once laid off for *ten years*—most anybody would as soon be discharged. He was a good man, but had made a mistake. He went to work on another road, and at the end of his suspension came back and took his old place, and has held it down ever since.

The B. & O. have some hard runs for their fast trains; on one division they have a grade of 117 feet per mile for 17 miles, and they want to get trains of from six to eight cars up there at the rate of 35 miles per hour. This work would call for an engine developing something like 1,500 horse-power—a pretty big locomotive. The great difficulty of a job like this is the same as with Hobson's horse, that was not able to make a mile in two minutes "because the distance was too great for the time." There is now on this grade a magnificent Baldwin 10-wheeler with cylinders 21x24, a 66-inch wheel and 160 pounds of steam. This engine will probably come as close to the desired time as anything on wheels—but it is a big contract. Here is a job for the Strong—can she do it?

There are few heavy passenger locomotives in this country that are on long, fast runs that keep their driving-boxes cool. From 7x8 to 8x8 is considered a fair driving-box bearing, while 8½x10 is above the average. In England many are made from 12 to 15 inches long. With the fire-box on top of the frames it ought not to be a very serious problem to properly hang the springs on a 15-inch box—and our big passenger engines would doubtless be better for the big bearings.

The P. R. R. are equipping the entire system with a steam heater arrangement of their own.

Simple Lessons in Drawing.

By Orville H. Reynolds.

EIGHTH PAPER.

Our previous lessons have been figures of two dimensions, viz.: length and breadth, drawn on a surface of like dimensions. We will now take up the delineation of solids—figures of three dimensions—length, breadth and thickness.

The drawing of solid objects will require more than one view—two, and sometimes three—in order to show the object to be represented, this depending on its simplicity. If of a complicated design, however, it may require not only three views or elevations, but many sections taken through such places as will tend to make it clearly understood, the point through which the section is taken determining whether vertical or longitudinal.

The views of an object which it may be necessary to show are a front view, called a front elevation; a side view, called a side elevation; and top or bottom views, called plans. These several views, when determined by projections, are known respectively as vertical and horizontal projections, thereby showing their relation one to the other by their position on drawing.

It now becomes necessary to know how to arrange these different views with reference to their relation to each other, and the reason why they are so arranged. To project is to throw out or forward. Orthographic projection is that projection which is made by drawing lines from every point to be projected perpendicular to its plane of projection.

In descriptive geometry the projection of a point on a plane is the foot of a perpendicular to the plane, drawn through the point.

In accordance with the principle here advanced we may take any solid, as a cube $D\ E\ F$, Fig. 52, and, projecting in space a number of points (all surfaces are supposed to be made up of points), be able to delineate the object truthfully on a horizontal plane.

Fig. 52 represents three planes of projection, each at right angles to the other; these planes are designated A, B and C. Let the cube be shown on plane A, then plane $D\ E$ of cube is horizontal, and planes $D\ F$ and $F\ E$ are vertical; the sides of the cube are therefore parallel to these planes of projection.

If now dotted lines are drawn from the angles of the cube perpendicular to the planes of projection, as from D to D and E to E', the surface $D\ E$ is projected on the plane of projection C, and we have a plan view of the cube. Projecting D and F on plane A, we have the front elevation, a projection of the surface $D\ F$.

On plane B we project in like manner $E'\ F$, and get the projection of plane $E\ F$, which is the side elevation. We now have three views of the cube delineated on a horizontal plane—front view, side view and plan.

It is plain that, if vertical lines $F'\ G$, $E''\ H$ and $D''\ J$, $F''\ I$ be drawn to intersect plane C, and horizontal lines are drawn from these intersections, that the plan $D'\ E'$ will be delineated from the projections of front and side views without any reference to cube $D\ E\ F$ whatever.

In like manner the surface $E''\ F''$ may be found from the other views by projecting lines $G\ H$ from $D'\ E'$ and lines $K\ L$ from $D''\ F''$.

The cube is taken in this case for an example because of its simple form. Three views are not necessary to show this figure, it being evident that if we know one dimension we know all, but the principle applies to all figures of three dimensions.

Let us suppose the planes of projection as shown in Fig. 52 to be hinged at $M\ N\ O$, and turned in space, as indicated by dotted lines, until they occupy the position shown in Fig. 53, thus bringing all the views to one common plane or surface, as would be the case when shown on the drawing-board. We find the proposition made in the beginning of this paper, "that the projection of a point on a plane is the foot of a perpendicular to the plane drawn through the point" to be verified, it being obvious that if the **T** square be placed on sides $D'\ F'$ on the elevation, that it will pass through corresponding points on the plan, etc.

In Fig. 54 we have the projection of a hexagonal prism in the form of a six-sided nut. Draw the line $A\ D$ and center lines $C\ D$ and $E\ F$, taking intersection of center lines for a center, and with radius equal to side of the hexagon describe a circle. From points $E\ F$, with same radius, describe four arcs, cutting the first circle; connect these points by straight lines; describe another circle to represent the hole, also a circle within the sides, to represent the chamfer or bevel of corners, and the plan of nut is complete.

The front elevation, a vertical projection, is now to be constructed. It is shown resting on base line $A\ B$, therefore must be in a plane vertical to the base line, then lines projected from points $E\ G\ H\ F$ through the base line will give the true location of these points.

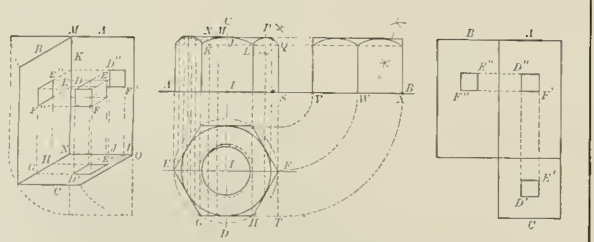


Fig. 52. Fig. 54. Fig. 53.

SIMPLE LESSONS IN DRAWING

The height of the figure, which is the thickness of nut, may now be laid off above the base line.

The chamfer on the vertical projection is now to be drawn in order to complete this projection. With radius $I\ J$ describe arc $K\ L$, which is the curved edge of the face as seen at its true size, this face being parallel to the vertical plane.

The other two faces standing at angles to the plane of projection do not appear like the one just shown, although exactly like it in fact.

The correct method by which to draw these two curves as shown foreshortened, is to find points through which to draw the curve as it appears, and is as follows: Divide one-half of the line $G\ H$ into any number of equal parts, as three, and from these points project lines through arc $K\ L$ at $M\ N$; next divide the side $E\ G$ of plan into twice the number of parts laid off on $G\ H$; from these points also erect perpendiculars; draw horizontal lines from $J\ M\ N$, cutting these perpendiculars on arc $K\ L$, when points in the curve are found which are to be traced by templet, taking in as many as possible always.

There is a practical method for drawing these curves as shown foreshortened, which is also applicable to other curves, whose office is merely to give a finish to the object, as in the case of the chamfer, executed as follows: Bisect the side of plan as at O, from which erect a perpendicular through front elevation at P; find the center for a circle which will pass through the three points $L\ P\ Q$ at R (see Fig. 40, seventh paper), and with radius $R\ L$ describe the arc. This method, with the compasses, answers all purposes, with the advantage of quick execution.

While the two views or projections of the nut are sufficient to truthfully show the object, there is still one more elevation to be delineated if we show three distinct views of the solid upon the plane of drawing-board. This third view is the side elevation, the side E of the plan will be taken to show in elevation. Draw horizontal lines from top, center and bottom of plan, cutting the perpendicular $Q\ S\ T$; take on the compasses the distance $S\ U$ for a radius, and describe an arc from S, cutting base line $A\ B$ at V; draw arc $S\ F$ to W, and $S\ T$ to X; from points $V\ W\ X$ erect perpendiculars to top line of front elevation, after which draw the arcs at top by the practical method. We now have a side elevation projected from side F in the plan, giving three views of the nut; these views showing the object perfectly, no sections of it are required to simplify what is already plain enough.

One word by way of advice: Do *not* leave these hints until the principles conveyed in the lesson are understood; they are not so difficult but that determined application will smooth over the rough places.

Their comprehension at the outset is all vital where success is desired.

One of the Oldest.

William Galloway died at Baltimore, Md., early last month, aged eighty-one years. He was the first regular railroad engineer in this country, and the oldest in point of service in the world, having been connected with the Baltimore & Ohio road for fifty-four years. Before the locomotives appeared, and when the cars were drawn by horses, Mr Galloway became the car dispatcher at Mount Clare Station.

When the Baltimore & Ohio completed its tracks to Washington, Mr. Galloway was put in charge of Lafayette Engine No. 13, and he ran between the two cities forty-six years. In all his service he met with but two accidents, in both of which his engine was thrown from the track. He was never sick in fifty-four years, and he missed his trip only four times, when something was the matter with the engine. He left ten children. Several of his sons and one of his grandsons occupy good positions in the railroad service. In 1887 he was retired with a pension, and since that time he lived quietly.

The engineers on the island of Cuba have always taken considerable interest in The Locomotive Engineer, and Chief Engineer Walter S. Phelps of Bueno y cia Estates, raised a club two years ago, that has recently been renewed with additions. Mr. Ernesto Villsanna, general foreman of the R. R. shops at Guantanamo, is spoken of as one of the brightest mechanics in his line, having had charge for five years, and been appointed in full charge when but nineteen years of age. Mr. Villsanna could, no doubt, tell us something interesting about the care of locomotives in the West Indies.

The Baldwin Locomotive Works have recently turned out a compound locomotive for South America. The machine is their four-cylinder design, such as is used on the B. & O., except that the low-pressure cylinders are above the high-pressure ones. This plan, it is believed, will cause less trouble from condensed water than the other.

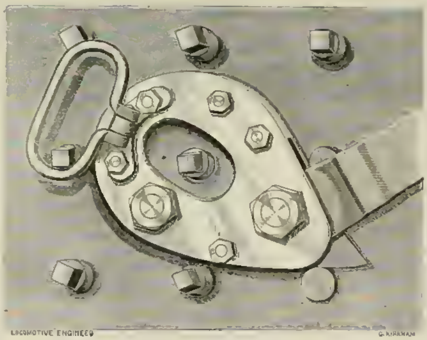
A company has been formed here to introduce the automatic vacuum brake, now so much used in England and Australia.

A Stay Bolt Cutter.

The accompanying engravings show in perspective and detail a very handy and efficient stay bolt cutter recently designed and patented by John Bersch, a railroad mechanic at Kingston, Pa. This cutter is small and easily handled by one man, and cuts off a stay bolt without straining the threads or loosening the bolt, and entirely prevents splitting the bolt, often done in breaking off a stay when not properly "nicked" with the chisel. This cutter leaves a clean sheared head to rivet down.

The sectional cut shows the bottom plate and all the moving parts; the two parts marked "rest" are merely pieces to hold the two main plates apart, so that the cutter and lever works between the plates. This sketch shows only the bottom or main plate, the top plate is shown in the engraving. The plate as shown above is regulated in thickness as regards the length you want your stub to remain for riveting, if ¼ inch leave plate ¼ inch thick, if $\frac{3}{16}$ make plate same as cutter cuts just over top of plate; the spring pulls cutter back in position for next bolt, when bolt is cut off. It requires about a 5½-foot lever, and then it is readily worked, at the rate of from 4 to 8 per minute. The sectional cut is just half size; the tool weighs 9½ pounds, with a stub lever six inches long. The long lever is a socket for the stub, making the tool easier to handle.

No difficulty is found in cutting ⅞ and 1 inch bolts with this device. Any further information will be furnished by the inventor.



STAY BOLT CUTTER.

The Greatest Locomotive Ever Built.

"Your pictur' of that big ingine of Cushing's reminds me of the story of the big ingine built for the New Orleans & Fiddler's Green Railroad way back in '56—she was the biggest ever built. Why, she was—what? Never heard of her? Well, now!" and the old-timer took a fresh chew of fine-cut and looked at the editor with pity.

"Well, then, here goes. In '56 I was down on the O. & M., a broad gauge road—six feet. Well, of course the men there were from all the roads then running in this country, but just at the time I speak of the road was under a manager from the Erie, and he brung down a lot of Erie engineers for some new ingins we got—at that time the Erie was the crack road of America—well, them Erie men kept mostly by theirselves, and were continually talkin' about the big ingines on the Erie.

"Nothing could be done or nothing could be got, but what they'd say it was *almost* as good, or as big, or as fast as something on the Erie.

"At one place on the road we all had to put up at a big boarding-house, and every evening them Erie men would sit and tell lies about the big things on the Erie, till we all got plumb sick of it.

"There was one runner there of the name of Hen. Burrows, that had more quiet fun in him than you ever see; he could tell anything with a perfectly straight face—well, Hen just made up his mind to bust up that Erie bragging, so one night he just put it up that none of us was to act surprised, or let on that we didn't believe all he said and he would tell a bigger ingine story than the biggest liar the Erie ever raised—an' he did.

"After supper we all set around the stove smoking and bragging on our ingins, the Erie men were at one of the tables listening to a new man from there, who was telling about some new 30-ton Hinkleys the Erie had just put on the road, when in comes Hen.

"'Boys', says he, 'I'm goin' to leave you, going back to run the big ingine on the N. O. & F. G.'

"'What road is that?' says one of the Erie fellers.

"'Never heard of that road and the biggest ingine on earth?' asked Hen. 'Well, *where* does that Erie road run to, anyhow? Ain't there no newspapers up there? Why, there ain't a child in the South as don't know all about the New Orleans & Fiddler's Green road and the big ingine.

"'Gentlemen, I had the honor to run that ingine from the day she was finished to last fall, when she went into the shop.

"'She was built to haul the big fiddle from Fiddler's Green to New Orleans and back, besides playing it while there.

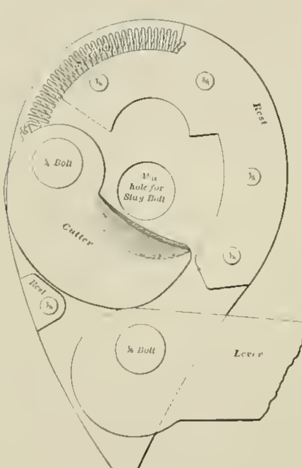
"'Talk about your Erie ingins', says Hen., lookin' around from face to face as he refilled his pipe, 'why, they ain't got one with a boiler big enough for her pump-barrel.

"'She was five stories high, and two counties and a township long.

"'She had drives a hundred and nine feet high—not counting the tire.

"'I don't just remember the size of her tank—wan't never down to it but once—but it took seven miles of the Mississippi River to fill it.

"'She had forty-two acres of grates.



STAY BOLT CUTTER, DETAIL.

"'Why, we us't to clean her flues by runnin' an old Erie engine with a snow-plow through 'em.

"'There was 80 firemen and 112 coal passers, and the men on duty was chained to the brake staff to keep the exhaust from suckin' 'em into the fire.

"'Erie? Why, good Lord, man, that ingin run 33 miles and stopped for water to every exhaust.

"'There was a regular bridle path on the running-board, and the man that went out to oil the valves rode horseback.

"'She had a valve travel of three-quarters of a mile, a four months' lap, and it was an hour and 'leven minutes between exhausts.

"'Onc't, when we got to New Orleans, the head fireman hollered up the speakin' tube for me to come down to the ash-pan deck, where ten or twelve of his men were working the steam hoes, cleaning out the ash pan, he said there was a big clinker just back of the front damper that the hoe wouldn't move. Well, sir, we went in there and there were 'leven broad-gauge Hinkleys that she had picked up in crossing other roads.

"'At the Mardi Gras last year they coated 38 flat cars with rosin, and used 'em for a bow to play the big fiddle. I played by notes set up like mile posts along the track—'bout a mile and a half apart—they was made of boiler plate, paper notes would tear all to pieces, the vibration was so hard.

"'A year ago this month, one awful wet night I was taking a hundred and ninety-six five-story cars of cotton up Snake Hill grade, when I had to go down the gangway a couple of stories to turn steam onto the ingin that moved the pet cock to the pump, and she got out of sand and slipped for a couple of minutes till I got back and shut her off, and, what do you think?—she had piled 80 miles of iron right behind the train—had to lay new track 80 miles out of New Orleans and chain it to the trees.

"'The bell weighed 19 ton, and her whistle could be heard in Memphis.

"'Had to use wood in her—when using soft coal the smoke obscured the sun, chickens went to roost, and crops wouldn't ripen.

"'It took 900 gallons of oil to oil around—used to put it on with a fire ingin.

"'If you knocked the fire out of her Saturday night there would still be smoke coming out of the stack Tuesday morning—it was so far from the grates to top of stack.

"'Machinists used to crawl into the cylinder cocks to set out her packing.

"'It took four barrels of oil to black her stack.

"'Gentlemen, her sand-box held 30 car loads, it took 1200 men three weeks to wood her up, she used more water every trip than this road does in a year, and it took more steam to fill one of her chests than the Erie road ever made. Why, dummit!' says Hen, stoppin' to light his pipe, 'think of a crosshead weighin' 29 tons, making a stroke every four months, and a main rod sixteen hundred and——'

"'Say, Captain,' says one of the Erie men, 'let's all have suthin,' and from that day out I never heard an Erie man telling about any thing big on that road."

Some experiments were recently made at Altoona to test the safety of the Frost dry carbureter system of train lighting. A carbureter was charged and then heated in a forge fire, hammered flat under a steam hammer, and otherwise treated very roughly, and all without serious consequences. The Frost light is fast gaining ground, and is a very successful train light—requiring no station plant. The only great precaution necessary to be observed in its use is not to charge the carbureters at night.

We are indebted to the Jos. Dixon Crucible Co., of Jersey City, for a bunch of lead pencils comprising every variety supposed to be needed by an editor. There are hard ones, soft ones, blue, black and mixed, but the ideal editorial pencil is not made by this company—or any other. We want a pencil that can spell and knows how to put in the proper proportion of commas and semicolons.

This year the Engineers Brotherhood will hold their annual convention at Pittsburgh, and the firemen, who meet but once in two years, hold forth at the Golden Gate.

A New Power Hammer.

One of the most useful and money-saving tools that can be put into a railroad shop is a good power hammer; for all ordinary repair work they are better than steam hammers, as they require no extra help, the smith himself controlling the stroke with his foot.

On this and page 105 will be found engravings of a hammer recently designed by Alexander Beaudry, the inventor of the well-known dead stroke hammers, and the forging presses that bear his name.

This hammer is built on an entirely new principle, and is of a particularly strong and handy design. The anvil block sets on a separate foundation, and is in no way attached to the frame of the hammer; the shaft, however, passes through a large hole cored in it.

The pillars form the frame of the machine, house all the working parts, and are themselves the guides for the head.

The hammer head, which weighs 400 pounds, is supported by a belt 3½ inches wide by 1¼ inches thick that passes through it and is fast to a parallel motion supported on springs, as shown in detail drawing. The head is counterbalanced by a weight in the wheel on the right side of the tool. The lever *a*, shown in this motion, being linked at each end, can be moved up or down without throwing its center out of line up or down.

There is an eccentric on each side of the frame having a 3-inch face and a throw of 6 inches, these give the motion to the head, six inches positive stroke, and about the same extra caused by the throw of the head and spring of the belt and its supports. The stroke of the hammer is controlled by a treadle that operates a belt-tightener, and can be instantly changed from a 2-pound blow to an 800-pound blow. The speed of the shaft should be 200 revolutions per minute. The belt pulley is 5½ face by 18 inches in diameter.

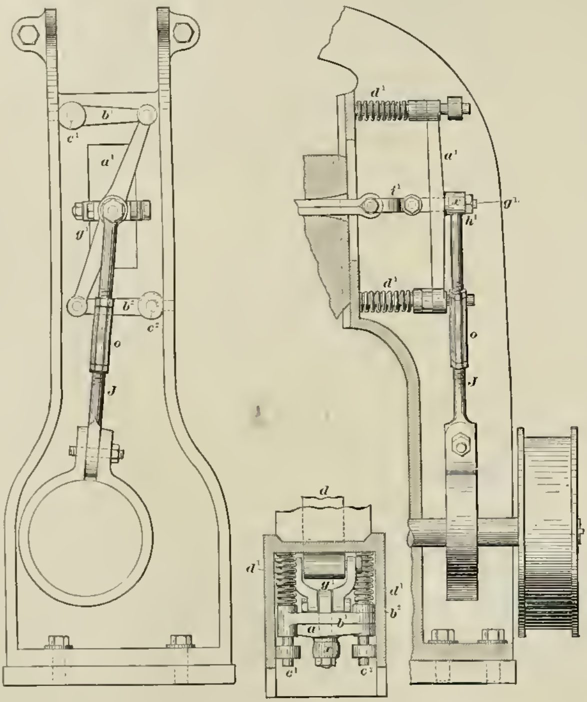
The anvil block is 28 inches high, the anvil and hammer head are removable and held in place by wedges.

There are no small parts to the tool, there is little to get out of order or to wear enough to affect the working quality of the tool, and the machine has a number of advantages over a helve hammer, especially where but one can be had. The blow is direct and square, like a steam hammer, and dies can be used as readily as in a drop hammer.

Beaudry & Co., 70 Kilby street, Boston, Mass., are the builders.

At the Baldwin Locomotive Works there is an elaborate restaurant where dinner is served to a large number of their workmen. The place is carefully kept, and good meals are furnished at a very low cost—so low, in fact, that no one can afford to carry a cold lunch.

The P. R. R. are equipping the entire system with a steam heater arrangement of their own development.



DETAILS, BEAUDRY'S POWER HAMMER.

Heat, Motion and Work, and their Units of Measurement.

By F. F. HEMENWAY.

FIRST PAPER.

The modern steam engine is a machine in such common use that it fails to excite attention. We do indeed give passing notice to something out of the usual order, as when engines of unusual power are placed in a steamship or elsewhere; but how few of us ever stop to think how much that enters into our daily lives is due to the genius of the men who have saddled and bridled steam for the every-day use of humanity. For the civilization we enjoy, we are indebted to the steam engine more than to any other agency; more than to all other agencies. Without it the civilization of the present day—or anything approaching it—would be impossible. It spins the thread, and weaves the cloth we wear; it fashions the furniture we use, and weaves the carpets we walk on; it annihilates distance, and places in our hands the products of the most remote countries; it carries us to and from the scenes of our daily labor, and though most of us cannot own a carriage, the steam engine enables us to travel with a convenience never dreamed of before its common use, and at a cost so moderate that the poor may now enjoy what the rich could not enjoy before its advent. It does all these things and a thousand beside that eclipse the wonders of Aladdin's lamp. Yet so gradually have the blessings of the steam engine been brought to bear upon civilization, so slow and steady has been the advance of steam, that there has been no place for wonder. We do not marvel at the rising and setting of the sun, or at the progression of the seasons, because we have been accustomed to these changes from our infancy. For similar reasons we do not marvel at the changes wrought by steam. Those men who have brought the steam engine to its present state of perfection have done more, a thousand times more, than all the conquering armies of the world, yet how little we know of them. The immediate change from the rigor of winter—from the frozen streams and frosty atmosphere to midsummer, would set every tongue in motion, and yet the change in human affairs, wrought by the advent of the steam engine, is just as marvelous.

I am not here to sing praises to the steam engine, or to those who have perfected it. But it is interesting, and instructive as well, to go back and briefly glance at progress in the use of steam. We see the well-nigh perfect steam engine of to-day, and if we were to see it to-day for the first time, reason would teach us that it was not always so nearly perfect. We should intuitively know that it was the result of persevering labor.

It is impossible to say how many thousand years ago men boiled water, and saw the vapor rise and float away in the air. And as some writer has pointed out, they could not have failed to observe that this vapor exercised force in escaping from the water, and making its way into the atmosphere. Here, then, was an essential fact that might lead to the conception of the steam engine. This steam, imperfectly confined, would lift the cover, perhaps a stone, from the vessel containing the water. It would do work. If it would do this work, it could be made to do useful work. That would be the natural line of reasoning. Why, then, did it require so long a time to put the knowledge of the fact that this vapor from boiling water contained the essence of motion, to useful purposes? It was because the utility of the knowledge of a fact depends so much upon concurrent knowledge. If some one, two thousand years ago, had conceived the steam engine of to-day, there was no one who could have built it. And it was not conceived, because no one could build it. Suppose it had been built, there was no use to put it to. There was no such association of ideas as rendered the conception of the steam engine possible. We can, to-day, conceive of many things fashioned from metals, because we know these metals exist, and because we know there are those skilled in putting them into the desired shapes. But if the knowledge of how to extract these metals from the ore, and to fashion them, did not exist, then we could not conceive of these things. It would be useless for one man to know much unless there were others who knew a good deal. It may appear, at first thought, strange, but it is nevertheless true, that every one in this world is interested in helping his neighbor to knowledge. If we get much ahead of the general knowledge of the world, we are, in the estimation of the world, cranks. The world will always be full of cranks, and their lot is not a happy one. But we are talking of the steam engine.

Something like two thousand years ago, Hero, of Alexandria, we are told, made the first steam engine. You have all seen pictures of Hero's engine, so I need not speak of its construction, further than to say that it contained the germs of the steam engine of to-day. It was not very much like a modern steam engine, but it contained within itself, what would, with our present knowledge of everything else besides the steam engine, have speedily become a thing of levers and shafts, and other accessories. But in Hero's time, there was not in the world the concomitant knowledge to bring this about. This lack of knowledge in others, so necessary to supplement what Hero knew, was mainly due to the fact that, in his time, those who worked did not think. They were not expected—were practically forbidden to think. Between the men who worked and those who thought, or thought they thought, there was as wide a distinction as can well be imagined. And this distinction prevented anything coming of Hero's demonstration of the utility of steam as motive force. Nothing ever came of it until this sharp distinction between working and thinking was broken down; until the philosopher, as a class distinct from the rest of humanity, practically disappeared; until men who looked at the utility of things, and who could both plan and execute, began coming to the front in the material affairs of the world. Hero's conception remained a toy until this change in human affairs came about. And but for this change, it would still be a toy. You may divide up labor as much as you will; you may assign this part to that one, and another part to another one, but you can never succeed if you separate brain from muscle. Without in some degree the ability to plan, there will never be the skill to execute; in even a more pronounced degree is it true that, without the skill to execute, the wisdom to plan will be wanting. The world is prosperous to-day because of this combination, and it is to this combination that the wonderful advancement in the arts and sciences is due. The history of every nation in the world will sustain this proposition. For thousands of years it was sought to work out some other civilization than that based upon a condition of general intelligence; but the effort was a failure.

When the time came that man was conceded the right to work and think in combination, the working mechanic turned his attention to the steam engine. Thomas Newcomen, a working blacksmith, added a cylinder in which a piston moved steam-tight, and John Cawley, a plumber, made some minor improvements, and the toy of the philosophers became a machine, valuable for the industrial purposes of the day.

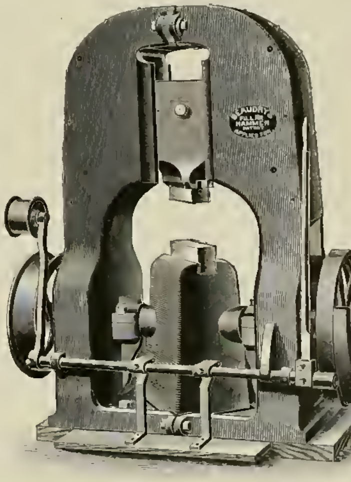
The fact worthy of note is that this, the first really great advance towards a practical steam engine, was made by plain working-men who thought. There is a lesson in this that should be valuable to each of us, and especially so to the younger men. The lesson is too plain to require elaborating. The men of science were outdone by the man at the forge. Thos. Newcomen's habit of fashioning iron to a useful purpose induced thought in a practical direction, instead of on severely scientific lines. The plain blacksmith distanced the ornate philosophers, because he knew more things that were useful than they knew. He was wiser than they, if we value wisdom by what it can accomplish. He was not trained to think as the philosopher thinks. He had trained himself to think in the rugged school of experience, where the best training comes from. One can imagine—almost see—Thomas Newcomen in the glow of his forge, thinking out the problem of that cylinder and piston that ought to have made him more famous than he is.

So on, from the time of Newcomen down to the present time, the advances towards the science of steam engineering have been made by plain workingmen; men who wrought with their hands and thought with their brains

But you do not care to hear the history of the steam engine, and the men who perfected it, nor I to repeat that history. It would not be essentially different from the history of a thousand other things that have helped the world along in its progress. The history of all these things brings to the front, what, according to common acceptation, are workingmen. Science has played a remarkably small part in the material progress of the world we live in. What I purpose, is to say a few words about getting mechanical work from coal, which is something that most of you practice during your working hours, and no doubt think a good deal about during hours you are not at work. Because the steam engine occupies the place it does occupy in the world's economy, and because the practical side of a question is always the important side, this question of getting useful work from coal is one of the most significant questions of the day.

It seems to the uninitiated a simple matter to shovel coal into the furnace of a boiler, supply the boiler with water, and use the resulting steam, but you who do this, know that to do it right, to do it so as to get the best attainable results, is very far from being a simple matter. On the contrary, you know that it is an exceedingly complex matter; a matter about which the wisest will always find something to learn.

We are continually being told that the process of getting mechanical work from coal is an extremely wasteful process. In the sense that it is possible to utilize but a small percentage of the latent energy of coal, as useful work, this is true enough. But



BEAUDRY'S POWER HAMMER.

while there is great loss of useful effect in the steam engine and boiler that cannot, in our present knowledge, be avoided, there are other losses that can be materially modified In order to see how this may be done, it is necessary to see what these losses are.

HEAT.

What the engineer has to do with first, last, and all the time is heat. Its production—speaking in a popular sense—and its utilization, are what mainly concerns him from the time he shovels the coal into the furnace till the exhaust steam escapes into the atmosphere or into the condenser. We speak—and properly enough—about the economical production and use of steam, but water—steam—is only a means to an end. It bears about the same relation to the subject that the harness does to the horse that pulls the load. For various reasons, one of which is that it is about the most common thing in the world, water is the best medium known for transferring the heat in the furnace to the place where it is utilized as motive power.

It was only a few years ago, as time goes, since heat was considered a mysterious *something* that insinuated itself in some equally mysterious way between the component atoms of matter, with the result of increasing the temperature of bodies and bringing about the phenomena known to be due to heat. This idea of heat was that of the ancient philosophers, who, after they had decided upon a thing, gave it but little consideration, for fear they might be called upon to reverse their opinion, thereby acknowledging that they were not infallible—a fear that happily does not exist at the present time. In the times of these old philosophers—the good old times we hear so much about—all investigation and pretty much all thinking was done by those who were trained to think, that is, by those who were assumed to be trained to think. It was not supposed that those who worked were capable of doing their own thinking, to say nothing of thinking for others. These old philosophers had a patent on mental effort, and when it came to things of practical value, they made a rather sorry mess of working their patent.

One of the first to see the inconsistency of the old-time theory of heat, was Count Rumford, and he was led to some experiments by observing the heat generated in the process of boring cannon. Any one of you who have ever drilled a hole in metal, know that the metal as well as the drill is heated, and that the duller the drill—the less freedom with which it cuts—the greater the heat. He was followed by other observers, the observations leading up to the present theory of heat. According to this theory, or, as we may say, scientific fact, because it has been demonstrated beyond doubt—premising that all bodies are composed of atoms almost infinitely small, too small to be seen by any means at our command—heat is simply motion of these atoms, and temperature, as indicated by the thermometer, is the measure of the intensity of that motion. For example, we communicate heat to a piece of iron, and we say the heat expands it, it grows longer. This is because the more violent vibration of the atoms demand more room in which to vibrate. The atoms of iron are held together by a force called cohesion—a force about which we know but little. And if we heat the iron sufficiently, there is war between the cohesive force and the force of heat, and the vibration of the atoms becomes so great as to separate them, so that the iron is melted and cohesion is in part—not entirely—destroyed. More heat will entirely destroy cohesion, and the molten iron becomes gas. Now, to bring this iron from a solid to a molten condition, and then to drive it off in the form of a gas, requires work, and this work is done by the heat that is applied To be brief, because we are getting onto ground that cannot be covered in a few letters, to bring about these changes in the piece of iron, required that the atoms of iron be put in motion, and the greater the change the greater the motion required. The atoms of the iron were never at rest, because they were never absolutely cold, which is a temperature very much lower than we know anything about by observation. In driving them off in the form of gas, we have increased the intensity of their motion, and hence their temperature. I notice the example of the piece of iron, because its three states, a change from one to the other, requiring the application of heat, and involving motion, lead up to the present understanding of the fact, that motion of any kind is the result of heat, in other words, that heat and motion are substantially synonymous terms; as Tyndall puts it, heat is a mode of motion.

WORK

Work is motion against resistance When heat is communicated to a body, the immediate result is work, because the motion of atoms is resisted by cohesion, and generally otherwise. But what we want to compare heat with, is another kind of motion, that is, motion that brings about mechanical results, as, for example, the motion of the piston of a steam engine against whatever opposes that motion. Without, perhaps, the best possible authority in the world for doing so, we will, for the sake of getting on common ground, call this motion of the piston of the engine against opposing force, mechanical work Let us see what this is and what it is not. If, by means of a lever, you try to raise a weight, but do not succeed, you may call it hard work, but mechanically speaking, no work has been done The weight has not been raised, and to do work there must be motion. If you pick up a weight from the floor you do work, because you raise that weight against resistance. But you may hold it at the height to which you have raised it for a week, and in so holding it you are doing no work, as we speak of work in a mechanical sense. The point to be noted here is, that to do work there must be motion, and that motion must be against resistance If you block the drive wheel of your engine so that the pistons cannot move, and then bring the whole boiler pressure to bear against the piston, no work is done, because there is no motion of the pistons

Now, we can, and do convert the vibratory motion of the atoms of a substance into what we term work—that is, motion against palpable resistance. That is just what is being done wherever there is a steam engine in operation. And that is all that is being done Then this work, that is, the equivalent of it, must go back again to heat. It has gone from heat, in the furnace of the boiler, through the engine, into work, and if we had means of tracing it, it has again appeared as heat, in whatever has resisted that motion. When you find your journal-box warm, some of it is there, and so on all through the connection between the engine and the machinery it drives, or the train it pulls, and the air that machinery puts in motion

Suppose we screwed down the pillow-block bolts of a stationary engine, until with full steam it would just run itself, then we should find the principal part of the heat we had converted into work right there.

The law of heat and motion is one of those natural laws that we cannot change. Motion, that is work, results from a change in the temperature, and while this change is taking place, we can couple on our little endeavors and get them pulled along a little ways.

We may take, as a familiar example of the transformation of one kind of motion into another kind, a shaft being turned in its bearings against the opposition of friction and attached machinery. In the shaft is tangible motion against resistance, and heat—atomic motion—will disappear from whatever is doing that work of turning the shaft just in proportion to the work required It requires a definite amount of heat to do a definite amount of work, as we might be sure would be the case from a consideration of the fact that all that is done is to change one kind of motion into another kind. In the work of turning this shaft, the motion we call heat has disappeared in one place, and appeared in another place as another kind of motion If we could follow the transformation further, we should find this motion of the shaft appearing again as heat, in whatever had resisted the revolution of the shaft All the heat that is utilized in moving the piston of a steam engine—all the heat of which the motion of the piston is an equivalent—could, if we had the means of following it up, be accounted for in whatever has tended to stop that motion. Out of these changes of motion between its two forms—motion of atoms and motion of bodies—we get useful mechanical work

It is well to impress these facts upon our minds. There are those who say the engineer has no occasion to bother himself about them. If he never aspires to do more than shovel coal and open a throttle valve in a perfunctory manner, it may not make much difference. But the engineer of to-day is not satisfied with this. He wants to know *why* he shovels coal and opens throttle valves. He expects to study steam engineering apart from running a steam engine. He expects to invent and improve steam engines. And aside from the question of pecuniary gain, the engineer has a desire to understand things for the sake of understanding them, just as much as the doctor or the lawyer has.

An Interesting Report.

An interested reader of THE LOCOMOTIVE ENGINEER sends us a little scrap of history in an enumeration of the locomotives in use on the

Name of Engine.	Name of Builder	Put on the Road.	No. and Size of Drivers	Total Weight.	Weight on Drivers
Allegheny	M W. Baldwin	July 9, 1850	4, 54"	45,275	25,825
Armstrong	" "	Dec 22, 1850	4, 60"	38,675	22,875
Blair.	" "	Sep 23, 1848	2, 72"	48,150	21,000
Beaver	" "	Sep 10, 1850	8, 42"	43,850	43,850
Cambria	Norris Bros	Jan 22, 1850	4, 54"	40,825	25,820
Clarion	M W. Baldwin	July 22, 1850	4, 54"	45,275	25,825
Clinton	" "	Sep. 5, 185	4, 54"	44,800	25,400
Columbia .	" "	Sep 18, 1850	4, 54"	44,800	25,400
Centre .	" "	Dec 9, 1850	4, 54"	44,800	25,400
Clay	Wm Norris	Oct 16, 1849	2, 48"	23,350	14,600
Clearfield .	M W Baldwin		4, 54"	44,800	25,400
Crawford.. .	" "		4, 54"	44,800	25,400
Erie	" "	Oct 7, 1850	4, 54"	44,800	25,400
Elk ..	" "	Oct 16, 1849	4, 54"	44,800	25,400
Franklin	" "	Oct 16, 1849	4 54"	30,650	16,750
Huntingdon.	" "	Nov. 16, 1849	4, 54"	45,275	25,825
Harrisburg ...	" "	Oct 16, 1849	2, 54"	17,800	21,000
Helsley	Wm. Norris	Oct 16, 1849	4 48"		
Indiana	M. W Baldwin.	Jan 22, 1850	2, 72"	48,750	21,000
Juniata . .	" " ...	Nov 2, 1849	4, 54"	45,275	25,825
Mifflin	" " ...	Sep. 1, 1849	2, 72"	47,800	21,000
Penrose	" "	Oct 16 1849	2, 54"	21,225	12,000
Venango .	" "	Oct 29, 1850	4, 54"	44,800	25,400
Wyoming	" "	Nov 26, 1850	4, 60"	36,675	22,875
Washington .	" "	Oct 16, 1849	6, 42"	34,675	34,675
Westmoreland .	" "	Sep. 7, 1850	8, 44"	50,975	50,975

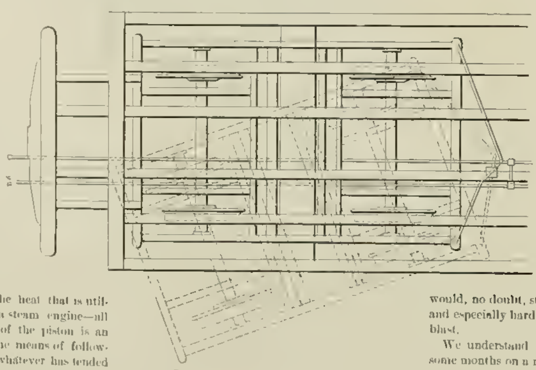
Copy of Fifth Annual Report Pennsylvania R. R. Co., for the year ending 1851. Phila., Jan., 1852

Pennsylvania R R. forty years ago. At that time 26 locomotives composed the entire power of the great road that now has on its own lines proper over 1,500 locomotives, and on the "systems" controlled by it, perhaps as many more.

Many of our older readers will, no doubt, recall many experiences with some of these old mills.

John Player, Sup't. M. P. of the Wisconsin Central, has completed designs for a new compound locomotive, and has received permission to build one at the Waukesha Shops. The design is of the 4-cylinder, tandem style.

It would be a blessed good thing if the eight-hour rule could be applied to some of our engine and trainmen who are making 24 and 36 hour runs.



DERAILING AIR-BRAKE APPLIER.

The Philadelphia & Reading are putting down a track tank on their Bound Brook division, and intend to run their express engines through to New York. No other straight and level piece of track located near the middle of the division being found, the tank will be laid on the long bridge over the Delaware River at Trenton Junction. The track tank and scoop were invented and first used by Ramsbottom, in England, some twenty years ago.

Derailing Air-brake Applier.

The accompanying sketch shows the general arrangement of a device arranged to automatically apply the air-brakes in case of derailment—a drop of four inches for any wheel being enough to open the cock and apply the brakes; also opening a cock in the signal hose, and blowing the whistle in the cab. This device is the invention of W. Edward Maher, Gen'l M M. of the Charleston, Cincinnati & Chicago R. R.

We will have to decline to publish questions about the horse power of stationary engines, when the matter simply calls for a little plain figuring. We have over a dozen such letters on hand now. On page 51 of the current issue will be found plain and simple directions for finding the horse-power of any engine—figure it yourself.

The Great Eastern Railway, of England, publish a monthly list of "farm houses and country lodgings to be let." This list tells the name and address of the landlord, size and description of lodgings, rent, and distance to nearest station, and distance of station from the cities on the line. This is done to build up a big suburban traffic.

A little black oil in your injector occasionally will keep down the formation of scale, and lubricate the packing so that all the handles will move easily.

A New Feed-water Heater and Purifier.

The cuts on page 107 show very plainly the plan proposed for heating and purifying feed water by Wm. W. Sutcliffe, of New Orleans, La.

Water is fed into the lower chamber and runs through a chamber filled with coke, called the filter chamber, and from there to the upper chamber and through the internal pipe to the boiler.

Mr. Sutcliffe thinks he will be able to utilize a great deal of heat now thrown out of the stack unused, and that in passing the feed water through a bed of coke the heat will separate and deposit on the coke a great deal of the scale-forming substances in the water How often the small quantity of coke that can be held in the stack will have to be changed will depend upon the quality of the water.

This heater is probably as good as any heater in the market, but has not overcome one of the principal causes of trouble with front end or stack heaters, and that is the formation on the pipes etc., when the feed is shut off, of sulphuric acid that rapidly eats out the pipes and sheets. Many of our older readers will remember the trouble from this source with the Magoon heater, which was a coil of pipe in the stack. The inside pipe would, no doubt, stand on a wood burner, but coal and especially hard coal, would eat it off like a sand blast.

We understand the device has been in use for some months on a road out of New Orleans.

In reply to inquiry of correspondents, we would say that the St John cylinder packing is a cast, snap ring packing, the rings being of peculiar form. It is, and has been for some years, in use on the Western Maryland Railroad, and is in general use on stationary engines.

The new cars of the Central Ry. of N. J. are lighted with the Pintsch system of gas light; tanks of compressed gas are stored under the cars. The new lamps of this system are very handsome ones.

Correspondence

Why the Black Hand Moves.

Editor The Locomotive Engineer:

In your April number the answer to J. W. Peterson, Boone, Ia. (2) does not seem to make the matter quite clear. I enclose one of W. A. B. Co's. pamphlets explaining the new valve. By referring to this it will be seen that in moving handle to emergency position, the port *j* comes over equalizing port *g* in valve seat, and permits air to feed from main reservoir to space *s*, where of course it shows on black hand of gauge. This is more marked when handle is not put at once to extreme emergency position. J. H. McFERRIN.

Topeka, Kan.

[This is practically just the explanation offered in April number: if handle is thrown to emergency very quick, the equalizing of pointers does not occur; if moved slow enough the port is in connection long enough to cause the movement as mentioned by our correspondent.]

Two Air-brake Problems.

Editor The Locomotive Engineer:

In looking up the air-brake subject, as I find it in practice, and on examination of the construction of its parts, and comparing notes with the condition of things as described by Mr. J. E. Phelan in THE LOCOMOTIVE ENGINEER of Sept., 1888, and later in book form, "Air Brake Practice," which is said to be correct, and intended for instruction of engineers and others. Will you call attention to where he says, on page 35, that the emergency check valve is held to its seat when train line is charged? It reads, "After emergency valve is worked open, then pressure in train line unseats check valve and flows directs to brake cylinder."

How does maximum pressure keep check to its seat, while a reduction in train line will lift check against spring, which is between emergency valve and check? Is it not held open by train line pressure, and closes only when train line pressure is removed? Also on page 69, in referring to slide valve in emergency position, "It allows air to flow from train line to brake cylinder, at the same time opens *larger opening* from auxiliary reservoir to the brake cylinder in addition thereto." On examination of slide valve, I find the opening at the top of "emergency port" to be considerably smaller than the feed "service" port. Can he figure to get more air out of the oblong opening on face of valve than will go in at the top? Also, why is it made so?

J. R. ALEXANDER,

Pittsburgh, Pa. Engineman P. R. R.

[The emergency valve on the new, quick-acting triple is composed of two valves and a piston. The lower valve seats against the train pipe pressure, and is held to its seat by a spring that also holds the upper valve against its seat; the train pipe pressure tends to *lift* the lower valve and to close the upper one. The upper valve is opened against the train pipe pressure by the slide of the triple admitting air above the piston of the emergency; this done the air in the train pipe lifts the lower check, and rushing past the upper one, enters the brake cylinder; as soon as there is as much pressure in the brake cylinder as in the train pipe—or a little before—the lower valve is seated. Train pipe pressure can open the lower check, and does, but cannot open the upper one; it must be opened from the top.

The service stop valve of the triple has a small opening at the seat (in the large slide valve), the port does not entirely govern the amount of air admitted, in going from "service" to "emergency," the oblong port is brought into communication with the passage to brake cylinder. It is made oblong so that it will give a full opening on the passage, in case of slight variations of movement. Mr. Phelan's conclusions are correct, unless it be in the statement about the larger openings for emergency.]

How I Set Valves in Ten Minutes.

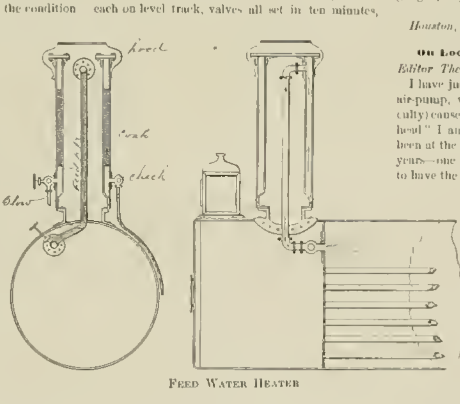
Editor The Locomotive Engineer:

In answer to our friend Mr. De Sanno, I would state to him, as regards the oblong hole in eccentric blades, the building shop of Baldwins always does it, and for this simple purpose, they set their valves by this oblong hole, and I assure you when their engines leave the shop, are about as perfect as valve motion can be made.

Now, the two round holes I mention with hammer-fit bolts are to keep meddlesome engineers from altering blades, for the same reason that eccentries are keyed on shaft—now will any one answer why this is not a good idea—and as I said before, a simple liner put in stationary gib or shoe, as commonly called, will always keep your valves square, and lead about same as when she came out of shop.

Now, I have not the time to write this up as I would like to, but will explain as best I can for the benefit of our friend Mr. Holland, of Oakland.

Now, Mr H., I would be pleased to have you sitting on a hill, and hear one of my little engines, 11 x 16, mogul type, Dickson make, coming up the hill with 12 standard loads 40,000 lbs. to the car—grades 70 feet to the mile, or 35 cars of 40,000 lbs each on level track, valves all set in ten minutes, and the rocker arm meets her equal vibration about on time. Well now I want you to catch on, if possible for you to do so on my poor writing, and if you do, you will say I am correct on the ten minutes, and I will take my longest way.



FEED WATER HEATER

Now understand that squaring a valve and setting one are two different things. I am telling now how to set valves when they are square, that is, suppose your valve sets over both ports square, and your valve rod is proper length, and to cut it short, all rods are proper length, except eccentric blades and eccentrics out of place.

Now to begin with, we will commence on right side of engine engine has plenty of lost motion.

Now take center—first put reverse lever in front notch, pinch her back until rocker arm moves, then pinch her ahead until you catch center dead, then make your mark with your gauge on valve stem. Then put reverse lever in back notch, then pinch her ahead until rocker arm moves, then pinch her back to catch dead on center, mark valve stem, scratch a letter B on your back-up mark, or letter F on forward, so you will remember your mark. Then go on left side, come ahead a quarter turn, proceed with that as you did right side, then come back to right side, catch centers as you did before. Remember if you are working in forward motion you must pinch her back until rocker arm moves, in that way you catch up all lost motion; now go back to left side, come ahead a quarter of turn, and proceed as before. Take your lap marks on valve stem, get a pair of fine point dividers, get the center of your lap marks, put your dividers in center mark, set them to one of your scratch marks, throw them around and make scratches with them, then put your two tram marks together, and whatever the difference is, the eccentric blade will want to be lengthened or shortened one-half that, that you can tell by looking at marks on valve rod; then you have them divided up even, now if your eccentric is wrong, you will move it until your tram drops in center punch mark at the end of lap, not in center mark.

Now this is my ten minutes racket. I have used up my ten minutes in setting valve, and have told my man what to do; go off, attend to other business, but Heaven only knows when he will get through, if he has to chip off back end of blade and cut the three holes out

Now I guess you will catch on to the ten minutes and the lost motion; this all on setting valves, setting and squaring valves are two different things.

As to gauging a valve without taking steam chest cover off, I expect is an old chestnut to our friend H, a good many shop and road men. You must know how much outside lap your engine has, then put two parallel strips on your guides, take a true two-foot square and set your rocker arm center with the square, then take valve gauge and mark valve stem, for example, if your engine has ⅞ lap, set your dividers ⅞, and mark valve stem with dividers, forward and back, take off steam chest cover, and you will find out you have them about properly gauged, if your valve stem is the right length.

E. A. CAMPBELL

Houston, Texas. Supt. M. P. and Mach.

On Locating Trouble in an Air-pump.

Editor The Locomotive Engineer:

I have just had a little experience with a six-inch air-pump, which (after I had overcome the difficulty) caused me to say to myself, what a "chucklehead" I am, to be fooled like this, after having been at the head of this air "dispensary" for ten years—one of the wipers said he thought I ought to have the "slack" in me taken up. I thought the suggestion a good one, and gave him a "snipe" for it. Now, for the benefit of some of your readers who are in the same business that I am in, and who have not had much experience, I will explain how I came to be fooled.

Engine 582 (N. Y. C. R. R.) runs from, or rather between Rochester and Charlotte, and as there is no one in Rochester to repair air-pumps, this and all other engines doing the same work are sent to Syracuse when air-pumps want repairing. This engine (582) came down in the afternoon, and the engineer wanted to get back as soon as possible, so I had to hurry to get her done, so he could get home before dark, and in my hurry I failed to locate the difficulty promptly. The first thing I did was to take off the top head, and found everything all right there, then I examined air valves, and found lower discharge valve worn out, the other valves were all right, and after examining air piston, to be sure it was tight, I put in new discharge valve, put on air cylinder head, and turned on steam, the piston went up to end of stroke and stopped—then I stopped, and scratched my head, and was soon lost in deep meditation, but not long—I went at it again, and removed the reversing cylinder cap to see if the reversing piston had performed its duty. I found it had—another pause. Then I removed the reversing valve cap, and—tumbled. The piston did not raise reversing valve enough to exhaust steam from top of reversing piston, and allow main steam valve to reverse; now what is the reason the piston don't raise the reversing valve? I have it, one of the reversing valve plate bolts was loose and sticking up, and if my head had been properly constructed I would have discovered it when I had the cylinder head off, all this I said to myself while taking off the cylinder head the second time

Well, after almost blistering my fingers, I finally got the head off, only to find that the cap bolts were right where they belonged. I did not get discouraged or mad, but kept at it until I found what caused the trouble, it was this On again taking off the air cylinder head, and removing air piston, I found a small piece of brass on top side of air piston, which was thick enough to prevent the piston traveling its full stroke, and moving the reversing valve far enough to exhaust steam from top of reversing piston, which would allow the main steam valve to perform its duty.

Now, if I had taken time to think, I would have discovered what the trouble was sooner than I did, and would have saved myself a great deal of unnecessary labor, for I have had the very same thing happen before. But I don't get fooled again on that.

Syracuse, N. Y. W. F. RELYEA.

Suggestions for Reverse Lever.

Editor The Locomotive Engineer:

Enclosed please find sketch and suggestions for new kink in reverse levers. There is an idea prevalent with some railroad men that a finely graduated quadrant or sector for a locomotive reverse lever is just the thing; well, perhaps it is, if valve gear could be kept in first-class condition and without lost motion, but, as this condition of things is impossible, why cling to these ideas in locomotive construction? Now, fellow railroaders, did you ever see a finely graduated quadrant that had been in use any length of time that did not have a lot of teeth or sections broke out? If so, what good is this fine graduation in locomotive valve motion? I claim that it is something that cannot be maintained in the wear and tear incident to locomotive service. Again, look at the general condition of the ordinarily graduated quadrant, what a rattle-trap condition some of them are in! And when the reach rod is connected to the side of the lever the condition of things is still worse, and, with the latch and notches badly worn, and two or three off-sets in the reach rod, it is a sad state of affairs for the man who runs the engine; and with a dry valve seat it has a tendency to make a man forget he ever went to Sunday-school.

There is an effort made to repair some of these troubles by dove-tailing a new section in and upsetting the latch, but it is not a good job when done, these sections get loose and drop out of one bar of the quadrant, and it happens to be our fancy notch that makes more trouble. It is in view of these troubles, and how best to get rid of them, that prompted me to send the enclosed sketch. I propose to make the quadrant of a single bar (like the Baldwin), drill a hole through wherever you want a notch or pocket, then counterbore from the top, and fit in a hardened bushing with a taper hole through it (make a fair driving fit); the size of the lower end of the taper hole is less than the hole drilled through the bar, as that leaves a chance to hack the bushings out for renewal.

The latch is made of one-inch square steel, with the lower end turned taper to fit the hole in bushing, and to be hardened. This is a quick, cheap latch to make, and, with the bushings, can be kept in stock. If a bushing gets worn in the hole, knock it out and give it a quarter turn, or change it with one of the back-motion bushings; by giving it a quarter-turn it takes up some of the slack by presenting a good side to the latch. If you will notice, nine out of ten of the builders place the latch in the rear of the lever, with no way to take up the lost motion in the latch but a set-screw. We may put in as many liners as we please, but the point of the set-screw must take the thrust of the lever, which has a tendency to pull ahead.

I propose to dovetail a strip of steel in forward edge of lever, and give the latch a hardened bearing to ride on. To take up wear I use a small wedge held in place by a set-bolt screwed into the wedge, the hole through the clamp to be slotted same as set-bolt in wedges. Another use for hole through quadrant is it allows all dirt to pass through without filling up the hole. Reach rod connections with lever should be made with a jaw to get a square pull on lever. Would make bar 1¼x1¾; counterbore, 1½ diameter by ⅜ deep; drill inch hole through bar; taper hole, 1 in. top, ¾ bottom. Fig. 1 is side view, Fig. 2 is view looking through *A B*. This lever is not patented—use it if you want to.

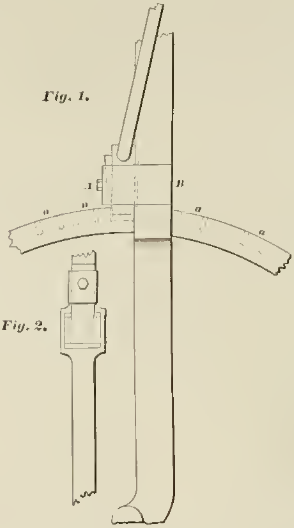
Corry, Pa. W. DE SANNO.

What Big Engines Will Do.

Editor The Locomotive Engineer.

As you are perhaps well aware, the N. Y. Central & Hudson River R. R. have always used eight-wheelers in freight service, and have simply increased the number of trains when business was lively; this was pretty good for engineers, as more of them had to be employed, and many a fireman got a chance to run a few months in the year.

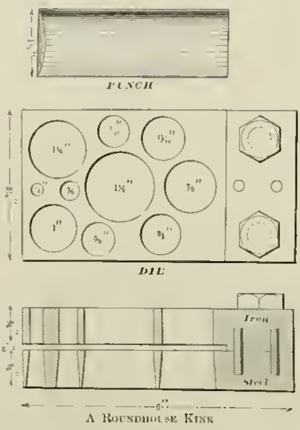
There is no doubt that this was not economical



SUGGESTIONS FOR REVERSE LEVER.

management, however, for some months ago the company put in service some very heavy moguls on the division west of Albany, and in the month of January there were hauled 252 trains less than in that month the year before, yet there were pulled 10,000 cars more. How's that? A good many will feel disposed to kick, and say that this all tends to do up engineers, but I do not.

Every machine device or system that will allow more work to be done for less outlay is a benefit to workingmen, as more will be done.



A ROUNDHOUSE KINK

The road I am on needs one big reform, however, and that is the shortening of the hours that freight men spend on their engines, 24, 36 and 40 are not uncommon, the first being a regular thing—it is too much.

Most of the men here are in favor of federation, and think when it does come that the possibility of a strike will be very dim. W. E. ANDROS.

Albany, N. Y.

A Question for Discussion—A Roundhouse Kink.

Editor The Locomotive Engineer:

To promote discussion among the boys I will propose a simple question. What would be the course to pursue if an engine broke a side rod or side rod pin, if the valve motion of the same is connected to one pair of drivers, and the main rod to another pair, as there are engines so designed, and in service—the elevated road engines in New York being a sample? Would the engineer be obliged to leave his train or not?

I enclose a sketch of a very useful tool for roundhouses and for shop repairs. As a general rule, roundhouse jobs are done in a hurry, and liners are cut out for closing eccentric straps, guides and similar work about the engine with an old cold chisel, and quite often a part of the liner turns over or doubles, and, twisting the part of machinery on which it is used, causes accidents and breakdowns. By using such liners, the engineer will soon find his eccentric strap or guide bolt loose, and by tightening it in a hurry, so as not to lose any time, the result will be a hot eccentric or guide—all on account of a rough liner and the hurry. Enclosed sketch is a plan and sectional view of a very cheap and handy tool, and if once used you would not like to be without it.

The lower plate is of steel, and is the cutter; the upper one, of iron, is simply the guide for the punch. There should, of course, be a full set of cupped punches made for the cutter. You can cut tin, iron or rubber, and save a good deal of time, besides doing neater work than the usual plan of cold chisel work. O. G. BRETTING.

Sedalia, Mo.

The Methuselahs of the Railways.

Editor The Locomotive Engineer:

All men are liars—only some have gone right on up to be 33 degree liars, while the great majority seem satisfied with the third degree.

Railroading and lying go together just like a young couple—affinity for one another.

It's a mighty powerful kind of Christianity that will keep an engineer from making the record of his pet engine 50 seconds out of 59. Nought is next to nine—that's near enough.

The average of us would come right home from the funeral of Ananias, and pull out a $28 watch and swear that it hadn't missed a tick for two years, and we never touched the regulator in our life.

But the biggest lies are about age—age lies are always carried in stock, same as a dinner-pail, overclothes or gall. It has been for years a habit of many railroad men and officials to gauge what a man *could* do by how long he *had* done it. If a man was a good man with air-brakes, they say "he o'rt to be—handled it for eighteen years on the Q."

Men who have run less than two years are considered as cub apprentices by those who have run five. An "old-time rocks" is the ideal. Experience is a good thing, but I don't believe it is necessary for a man to always make his own, any more than it is necessary for him to touch off a can of powder to see if it will explode—other people's experience with powder is conclusive with me.

You put the best man on the road in for round house foreman, master mechanic or superintendent, and the first year or so he will refer to the time he ran an engine or train, as so many years—always counting the odd months over as a full year. In a couple of years, and especially in talking to new men or young ones, he will include in that time the brief period of his existence when he was braking or firing, and in ten years he will set back the date till the time he remembers how a train of cars looked—and he will tell it so often and so honestly that he will believe it himself. Now I don't suppose this is any news to you—guess when it comes to a lying match you won't get the booby prize—but I want to call your attention to it, and just say it was started to make life tolerable to young men, does no harm, and just a little good. I want to warn the boys to not bring it home with 'em, however.

The other night we had company, and Mrs. A. had just been telling how we had to git married while my train waited, and I had to go right out with a train of soldiers (I am going to have a pension out of that yet, see if I don't), which was all facts. Well, half an hour after I was telling a railroad story, and incidentally mentioned gettin' married, and reached back, as usual, kind of familiar like, for a date, overreaching just enough to fix the wedding in the year Mrs. A. was born. She jumped the track right there, and spoiled the whole story.

Away back in '78 (I came mighty near saying '58—that's when I went firing) I was performing as roundhouse foreman (twilight foreman), and had occasion one night to hustle around for an extra fireman for an express train. The only material available was a young fellow, recently employed, who was on the switch engine; he had had a couple of years' experience on some other road, or roads, I believe. His head was a small collection of other little accessories attached to a large bump of talkativeness. The engineer was the oldest on the road; ran the first engine; deacon in the church, and a good man. Old Frank would no more tell a lie, knowingly, than fly, but, like all other railroaders, his memory of dates was a little offish, and about twice a year some of the older citizens had to tell him that it was the *charter* the road got in 1835, and not the *first* engine, which came in '47.

Well, the next night the express came up on time, and as old Frank put his finger prints and name on the register, I asked him "how that young fellow done."

"Young feller?" says he, with a pitiful look at me. "Young feller?" "Why, John, that man has fired for two years on every road in North America, some on most of 'em in South America, and all the principal ones in Europe, Asia and Africa, and a little in Australia and New Zealand. Young feller? why, man, he's a hundred and ninety years old according to his own figgers, don't call him no young feller."

JOHN ALEXANDER.

A Time-saving Wheel Truck.

Editor The Locomotive Engineer:

To those of your readers who have many engine truck and tender truck wheels to change, the following description of a wheel truck we made here will be of interest, I think. Take a piece of sound oak plank, 2⅝" x 16" x 37"; 10" from one end cut a hole in the center of plank, which will let pass through the top end of a common 6' screw jack. This hole should be cut so that the jack will stand in a perpendicular position when the plank is at the angle shown at *F*, Fig. 1. Then have forged an axle of 2" x 2" iron, bent in form of *A*, Fig. 1, turn the journals 1⅛" x 3¼". The center part of this axle should be flattened to about 1" x 2" to admit of the bolting over it of the piece of boiler steel *B*, Fig. 1. This plate is of ⅜" steel, 8" wide, and bent in the form of *B*, Fig. 1. This is bolted to the bottom side of plank over the axle with ⅝" bolts, as shown at *F*. In bolting this plate to plank I used four pieces of ½" x 1½" x 12" iron, one of which passed over each end of the steel plate. The other two pieces were let into the top side of plank flush. Each end of the steel plate takes three bolts, which also pass through the iron pieces mentioned. Then I put a ⅝" bolt through the plank and each end of the iron bars, just at the edge of the steel plate. This plate should be very securely bolted to the plank, as it carries almost the entire weight of the load. The carrying wheels shown by the dotted lines *F*, Fig. 1, are 8" in diameter, with 2¼" face. The small lead wheel is 4" in diameter, with 1¾" face. This wheel is let into the center of plank near the end, as shown. For this we used a friction roller for tender truck, which had the journals cast on. For boxes we took an old pair of hand-car boxes, and bored them out to suit. Now, on each edge at the end of the plank which carries the lead wheel, I bolted a steel piece slotted as shown at *C*, Fig. 1. These were made of ½" x 3" steel—made them of the broken top leaf of a driving spring—these pieces are fastened to the plank with 1" x 5" square-headed bolts, which pass through the slots, and screw into the plank, the same as lag screws. These steel pieces must move easily backward and forward on the bolts.

In order to have the truck carry wheels from 28" to 33" in diameter, I made two jack heads. The one marked *D*, Fig. 1, is used when 33" wheels are to be loaded. The one marked *E*, Fig. 1, for 28" and 30" wheels.

To load a pair of wheels on this truck, proceed as follows: Run the truck under the axle, and push it forward until the forward end of plank strikes the inside edge of wheel flange, this will push the ends of slotted steel pieces back flush with end of plank. Then place the jack head directly under axle, this brings the front end of the plank square with wheel flange. Then by raising jack, wheel No. 1, Fig. 2, will be raised first, for (if the truck is made to these measurements) when the truck is placed in position described above the jack head will be 1" nearer to wheel No. 1 than to wheel No. 2. Raise wheel No. 1 until, by pressing down on it, wheel No. 2 will be raised above the top edges of slotted steel pieces, when they can be pushed out under the flange of wheel No. 2, which (when pressure is removed from wheel No. 1) will drop into the notches in steel pieces, and the wheels will rest in a parallel position, as shown.

We find that two men, by pushing on wheel No. 1, can run a pair of wheels thus loaded any place in the roundhouse.

I had two pine planks made 4" x 14" x 53", and hinged them together, and faced the top sides with No. 16 sheet-iron, along the outer edges of each plank on the top I screwed a piece of ⅜ x 1" iron, the entire length, to prevent the truck from running off. If these planks are placed across the pit and spread out, a pair of wheels can be run out and in on them nicely.

If any one of your readers will build a truck of this description and try it, I am positive that they will like it, as two men can take out and put in a pair of wheels in half the time three or four men can do it without the truck, and do it, too, without danger to themselves.

L. C. HITCHCOCK,
"Soo" R. R. Foreman.

Minneapolis, Minn.

Fig. 1.

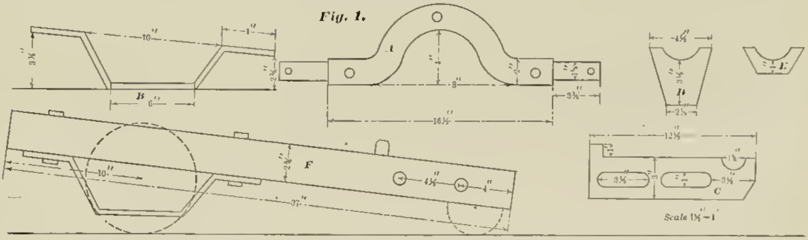
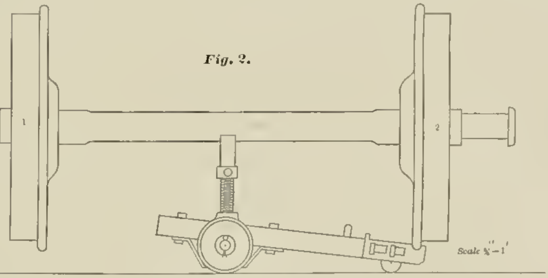


Fig. 2.



A TIME-SAVING WHEEL TRUCK.

Slipping Drivers Going Down Hill.

Editor The Locomotive Engineer:

I would say that I run an engine that did slip, and I give her sand, and she stopped. We had been running down hill about a mile from where I shut off. There is another engineer on this road that she's done the same thing with. I have been going forty-five miles an hour, and have her slip up, and I shut off steam, and she would slip till I give her sand. I have let her go eighty rods sometimes before giving sand. Why is it that she will slip so long after shutting off steam?

JAMES A. NUTE.

Nashua, N. H.

[We wish our correspondent would give us all the particulars noted when this slipping occurs. What is the grade, size and style of engine, weight on drivers, etc.? What causes the engine to slip after steam is shut off is more than we can see. All the pushing of the train would exert itself at the axle, and in no way tend to slip the drives ahead. If there is any one who has noted similar diseases in locomotives run by them we should be pleased to hear from them.]

W. E. Maher, Gen'l M. M. of the C., C. & C., is having ten ten-wheelers, 19x24 cylinders, built at Baldwins.

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CONTENTS.

The Question of Federation.

The flood of correspondence on federation *pro* and *con* we shall have to decline—if it were all published it would fill the paper. Federation will become universal in time; in fact, is now in full operation, except the engineers. The argument against the engineers' special committee, for not getting up an original plan of federation, is useless. Suppose they did get up a new plan, who would they federate with? They have only the choice to join the present federated body or stay out of it. They can't "federate" alone. It would seem as though an organization strong enough to secure valuable "agreements" would be better able to renew and enforce them than ever if their numbers were doubled. A general who has taken a fort with an army of 5,000 men does not usually surrender it because he has been, reinforced by 50,000 The question is not whether or no we want federation—federation is here. The question now is, shall this magnificent array of organized railroad men fill the chairs of their supreme council with men of brains, men who know enough to be reasonable, honest and just; men who will be firm yet gentle with their strength; men who will meet rail road officials on common ground, and become so grand a board of arbitration that the railroad strike will be forever dead; or will they let the council become an autocratic ring of agitators and hoodlums who will make the orders behind them the clubs to show their authority, and the sewers to convey their spleen against "capital"? We have confidence in the good judgment of American railroaders when they "sit down to reason together," and believe that the present high character of the supreme council will be maintained.

A Hard Hit at Mr. Webb.

In a long report of an accident on the London & Northwestern road, in England, the *Railway Herald*, of London, says:

"The London & Northwestern Company has always been backward in the adoption of any improvements not suggested or introduced by the chief locomotive engineer of the line. It was only a short time ago that its faith was pinned to the Clark & Webb chain brake as the best possible. Driven from this position by circumstances over which it had no control, it adopted the simple vacuum as its next fetish, and failing to obtain salvation through that, *adopted* the vacuum automatic to its requirements, or prejudices.

"To argue, as was done before the coroner and the Board of Trade Inspector, that the driver should have had his train under the control of his hand-brake, is practically to admit the unreliability of the form of vacuum brake with which the train was furnished, and is in itself a strong condemnation of the company for its employment."

The same trouble is experienced in this country to some extent, not in the adoption of brakes, but of other appliances, and on many of our big roads an invention has to be "improved" to be adapted to the needs of the service—often cutting out the lights, liver and backbone of the invention proper, then when it fails condemn the inventor or the makers.

Some American Inventions that were First Adopted in Europe.

It is pretty generally acknowledged now, that the shifting link motion was first made and used by W T James, in the city of New York, about the year 1832; it was condemned in this country, but adopted at once by Geo. Stephenson, and became known as his invention. Mr. Rogers was the first American builder to appreciate its merits and persist in its use on his locomotives.

The Allen or double-opening valve—one with a passage through it to increase the steam opening—was invented by an American, Mr. Allen, who tried in vain for years to impress its merits for fast locomotives upon American railroad men, it was no sooner introduced in England when it became a general favorite, and is yet known as the "trick" valve. Here it is just coming into general use—long after the patent has expired

The English roads used the brick arch with success for a long time before it came into anything like general use here. Yet it was invented and introduced by Geo. S Griggs, on the Boston & Providence road, a great many years ago.

Don't Run the Risk.

An engineer is usually commended for sticking by his engine and trying, to the last moment, to stop his train. It was reserved for a coroner's jury in this city to find that one poor fellow of this stamp lost his life "through his own neglect."—*Phila. Ledger.*

Try to stop if you have time, but get off anyway You can put the brake on as you fall off—if the engine has no brake, get off quick. Meeting grim death with your hand on the throttle is no honor. The wives and children of many a railroad hero of this kind are in need of bread to-day Be a hero to your own family.

Some excuse is perhaps necessary for the present issue of the THE LOCOMOTIVE ENGINEER; it has been thrown together hurriedly, and shows a dearth of original matter. The editor has been nearly half the month at the bedside, the bier and the grave of an only child; a man cannot write when his heart is full of sorrow, and his brain seared with grief, when the noonday sun seems dark, when the flowers and the grass seem dead and dry, when the songs of the birds seem like funeral dirges, and the words between the lines upon the paper fade dreamily away before the misty gaze, and seem to disappear in long rows of little graves.

A statue has just been erected in Newark, N. J., to the memory of Seth Boyden, one of the ablest mechanics of the first half of this century. His inventions and discoveries were many and varied; among them, patent or glazed leather, malleable iron, nail machines, the machine for making split leather, and a cut-off for steam engines, the first one controlled by the governor. In 1837 he built for the Morris & Essex railroad the "Orange," the first locomotive built in the State of New Jersey. He introduced the present outside connected engine, being the first to discard the crank axle. Seth Boyden was born Nov. 17th, 1788, and died March 31st, 1870.

It would make considerable difference in your pay check—if you run by the mile—where your run was. The English mile, as you know, is 5,280 feet, but the standard mile of different nations varies greatly, there being no less than 32 different standards; the shortest is the Chinese, which is but 1,887 feet, the longest is the Hessian, which stretches out for 58,500 feet. The miles of all countries except China, Lithuania and Russia, are longer than the English mile.

Some of the roads out of Pittsburgh get their coal delivered on the chutes at 85 cents per ton—not much of an excuse for the motive power officials to experiment with compound locomotives or valve motions. In the extreme southwest or Mexico, where coal sometimes touches $10, any device that will save five per cent. of the fuel would be worth taking pains with.

The big U. P engine illustrated last month was one of some 40 built Baldwin's Cookes' and Rome have all furnished engines of that size recently.

Books Received.

LOCOMOTIVE ENGINE RUNNING AND MANAGEMENT. A Treatise on Locomotive Engines By Angus Sinclair, Secretary American Railway Master Mechanics' Association, etc. John Wiley & Sons, New York. Price, $2

This work is one of the best known and appreciated of all the works published for enginemen. Its popularity is shown by the fact that it has reached the fourteenth edition in less than six years In the present edition Mr. Sinclair has almost a new book, having taken out much that was of little use and replaced it with fresh matter of practical value. He has elaborated and extended the chapters on combustion, and has a chapter of questions and answers for the examination of engineers and firemen.

The chapter on radial and other odd forms of valve gear has been cut out, and standard practice in the matter of valve motion more fully covered and explained

The articles on air-brakes are brought up to present practice

This is the only book ever written about "running" locomotives, and its main value is in the excellent chapters on road service about the break-downs, emergencies, etc. No engineman should be without it in his little collection of useful books.

ASKED & ANSWERED.

(36) Statistics, Washington, asks:

What are the railroads of the United States worth—the whole system complete? *A*.—Estimated at nine and a half billions of dollars.

(37) W. S., Laulsbaugh, Oakville, Md., asks:

What is meant by consolidation and shifting locomotives? *A*.—A consolidation locomotive is one having eight wheels connected, and a two wheeled truck. A shifting locomotive is one used for switching.

(38) O. C., Boston, Mass., asks:

Is it possible with the modern sight-feed lubricator, with double feed (one drop-glass for each cylinder) to "feed across," or both glasses show feed and both feeds go to one cylinder? *A*.—On many kinds it is, and is a serious fault. Name the maker.

(39) C. E. B., Groton, Mass., asks:

Who invented the variable exhaust? *A*.—Ross Winans used it on some of his earliest locomotives. He secured a patent, and sued many builders and railroads for infringement, but it was proven that it was used some years prior to Winans by the Hackworths, in England.

(40) F. S. S., Charlestown, Mass., asks:

Is the automatic brake used much in Great Britain? *A*.—Automatic brakes are fitted upon about one-third of the rolling stock in Great Britain, part of this being air and part vacuum. Non-automatic brakes, both air and vacuum, are quite common, yet many roads run without continuous brakes, and a great many cars have no brakes whatever.

(41) M. R. B., Alexandria, Va., writes:

1. I have eighty pounds of air with handle in full release position. I take eight pounds out of train pipe; what is pressure in brake cylinder per square inch? 2. If I have eighty pounds and take out twenty pounds, what is pressure in brake cylinder per square inch? 3. When engineer's brake valve handle is moved from full release to emergency notch and left there, why is it all of the air does not escape out of train pipe? All of these apply to brake valve of '88. *A*.—1. About twenty pounds. 2. If you reduce train pipe pressure twenty pounds by the service stop exhaust, it would probably apply the brake full, giving about fifty pounds per square inch on the piston head. With the new quick-action triple valve, and a twenty pound reduction through emergency, you could get in the neighborhood of sixty pounds on the piston. 3. The air will all escape from train pipe if valve is left in emergency stop—the gauge is shut off and does not show the reduction.

(42) F. J. C., Oswego, N. Y., asks:

Could an engine run with her back-up eccentric rod broken by weighting bottom on link? Heard it was done by putting piece of rail two feet long at the bottom. Also let me know is there any difference in length between go-ahead and back-up rods? *A*.—It is barely possible that an engine could be moved as you say, but it is not safe or practical. It takes a long time to fix up, and there is little if any use in it—unless the back-up eccentric rod broke on an engine already on one side, and it was necessary to get in. This question is like the one, "How to run with both front cylinder heads knocked out," the answer being to stop up both front ports so as to clear the valve and the piston. You might just as well tell a man on the road to make two new heads. The answers given in this column are intended to cover general practice. There should be no difference in length of blades, yet they are sometimes varried in valve setting, to secure the best results at some one point of cut-off.

The "Engineering News" on Air-brakes.

The *Engineering News*, of this city, thinks we were wrong in trying to point out that it was wrong in blaming the engineer for not being able to release the brakes in the Hamburg disaster. Speaking of our statement that it was impossible to release the brake, as long as there was an opening in the train pipe, it says:

"Our contemporary forgets that there are two kinds of conductor's valve, both of which have their advocates, and both of which are largely used. One of them, the older form and the one still most largely used, stays open only so long as held open. On its release it becomes instantly possible for the engineman to release brakes in the usual way. The other style is a plain cock, which, if once opened, stays open until closed by hand. We understand that this last style was *not* in use in this case, but whether it was or not makes no difference, because the facts are that in the Lake Shore disaster the engineer failed to place his brake valve on lap when the conductor's valve was pulled open, and so lost all the air from the main reservoir through his own valve. He was, therefore, clearly in fault in any case, since he had no right to assume that the conductor's valve would be left open, even if it was not of the self closing type."

If, as our contemporary assumes, the conductor's valve was pulled open, and allowed to close, the engineer's valve would have kept supplying air to the train pipe, and the brakes would probably have released before a stop was made under ordinary circumstances. It is plain that the conductor was frightened, and he did not hold on to that self-closing valve very long. It looks as if the conductor's valve was one of the sort that stay open, for had it been a self-closing one, on so short an application, the air could not have all escaped from the engine drum, especially if the valve was in feed position. This *instantly* business in releasing air-brakes when once set, does not work. If it is proven that the engineer did not put his valve at lap, it will show that he did not understand the true nature of the stop, and how necessary it was to release quick—he is not to blame for not being able to see in the cars, and behind the train. We would call the attention of our contemporary to a railroad rule almost universally in use in this country—and not a bad one either—which instructs the engineer to open his valve and assist in making a quick stop when he feels the brake go on from the train—it being assumed that something is wrong. If this rule is in force on the Lake Shore, the engineer can be blamed for not doing more instead of less to make a stop where the final crash came.

Again our contemporary, in explaining its statement that after the first break there was much air in the auxiliary drums that could have been utilized for braking, it says:

"Our contemporary also asserts, with much confidence.

"'It was impossible to release those brakes, when set at Dunkirk by the first break, without (restoring the pressure in the train pipe, or) bleeding out *all* the air in the brake cylinders and auxiliary drums. So long as there was a pound of air in the auxiliary drums and the train pipe was open, the brakes would set.'

"There is a little appendage to the brake-gear known as the 'four-way cock,' which our contemporary has apparently forgotten, but which makes the above statement untrue. We did not assume this four-way cock to have been used."

On the quick acting brake, those built since 1887, there is no "little appendage" in the shape of a four-way cock, and the brake cannot be changed or cut out. On much of the old equipment the handles of these cocks have been removed or are wired up to prevent men from meddling with them. Brakes are used to stop the cars when in motion, and it is plain enough that if the four-way cock was used to retain "air available for braking," the cock would have to be turned by hand to use it, and as the cock is under the car, it cannot be reached.

This idea of putting the power to apply a continuous brake into the hands of the trainmen, and then blaming the engineer for not being an antidote for all their mistakes, is wrong.

Some Information About Interlocking Switches and Signals.

The Johnson Railroad Signal Company, of Rahway, N. J., have recently issued a catalogue of their interlocking signal appliances, and in the preface of the book tell a great deal that is of engrossing interest to those interested in signaling. The catalogue is a large book, very fully illustrated, and one that should be in the possession of every office of the operating departments of railroads. We quote from it as follows:

The credit of the introduction of interlocking signals in the United States is due to Messrs. Toucey & Buchanan, of the New York Central & Hudson River Railroad, the former, general superintendent, and the latter superintendent of motive power. These two gentlemen very early saw the advantages of concentrating switches as much as possible so that they could be worked from a central point and protected by a much smaller number of signals than would be necessary if a signal was placed for every switch. They devised an interlocking machine, and the first one was fixed at Spuyten Duyvil Junction, in New York City, in 1874, and remained in service until 1888. This machine compares very favorably with the earlier machines used in England, which was the birthplace of interlocking signals.

The Pennsylvania Railroad was also early in the field, but they sent to the well known firm of Saxby & Farmer, of London, England, for a complete machine, etc., with signals and connections, which were sent over and fixed at East Newark Junction on the New York Division, being put into service on February 11, 1875, where they are now working.

In 1876 Messrs. Saxby & Farmer sent a very complete model of their system of interlocking and block signals to the Centennial Exhibition in Philadelphia. This exhibit did more, perhaps, than any other one thing to acquaint railroad managers in this country with the systems of interlocking and block signals, which were then extensively used on European railroads.

Very shortly after this, the elevated railroads of New York were built and equipped at the most important points with the Saxby & Farmer machine, manufactured by the Jackson Manufacturing Company, of Harrisburg, Pa., who had purchased the patent rights for this country.

The slow progress of the introduction of interlocking, up to the year 1887, was due partly to a want of knowledge of its advantages and partly to the serious depression of trade which was felt so long.

The advantages of interlocking may be classed under two heads:

I. Increased safety.

II. Increased facility in the handling of traffic at busy points.

Increased safety is assured by working each system of switches and signals from a central point, the mechanism for operating such system being so arranged that, so long as the apparatus is kept in good condition, movements taking place under the sanction of the operator, as expressed by the lowering of a signal or signals—and no other movements can take place without such sanction—are secure against collision from conflicting directions, and disturbance of the switches traversed by such authorized movements.

Much of the increased facility that may be obtained depends upon a good lay-out of tracks as well as of the signals. When switches are arranged so as to obtain the greatest number of movements with the least possible running, much more rapid handling of trains can be obtained with safety by one man who handles all switches and signals from an elevated point, where he can see each movement and anticipate each requirement, than by a number of men who have to run from switch to switch to throw them.

One can best realize this by watching the movements of trains at Grand Central Station, New York, Broad Street Station, Philadelphia, or the Boston Yard of the Boston & Albany R. R., and comparing them with those at other busy places which have no interlocking.

The introduction of interlocking signals and switches has not always been a complete success, for obvious reasons, viz.: faulty arrangement of tracks and incomplete signaling. The existence of either or both these conditions will, of course, mar the complete efficiency of any system, and if, from desire to economize or other reasons, systems having such faults are introduced or allowed to remain, satisfactory results can scarcely be expected.

It is very satisfactory to all concerned in good signaling to know that an increasing number of roads are alive to the importance of having a properly equipped signal department. Several important roads have appointed signal engineers whose duty it is to superintend the construction of new work and maintain it in good condition afterwards.

In making these appointments it is well to secure the services of men of some years' experience, because although signaling may appear to be very simple and is so in small plants, there are so many intricacies in large ones (and every road will have some such), that nothing but long and varied experience can fit a man to fill the position satisfactorily.

There is something about signals very fascinating to the inventive faculty, and the application for patents, and the patents granted for signaling devices, must approximate very nearly to the infinite number of car couplers and rail sections. While it is very laudable to desire to improve signaling devices, it must be remembered that there is great economy in uniformity, and changes should not be made unless some decided advantage is gained.

The experience of twenty-five years has pretty conclusively shown among other things that the semaphore signal is the most satisfactory type of signal; that switches and locks should be worked by pipe; that facing switches should be fitted with facing point locks; that facing point locks should be duplex, *i. e.*, so arranged that, in the event of the breakage of connections, the plunger of the lock cannot be thrown into the wrong position of the switch; that two lines of wire should be used to each signal; that signal blades should be so constructed as to go to the danger position in case of breakage of connections anywhere between the operating lever and blade; that wires to distant signals should be automatically compensated; that iron plates should be fixed under switch points to keep the track accurately to gauge; that plungers of facing point locks should not be pointed; that cranks and pipe compensators should be fixed on foundations firmly imbedded in concrete; that all side tracks connected to main tracks should be "trapped," *i. e.*, have a derailing switch to prevent cars coming onto the main track until the switch is set for the side track; that a signal should be given for every train movement; that high signals should only be used for main running tracks; that separate signal posts should be used for each track running parallel or converging; that one post with one or more blades (various systems are in use for indicating the route open) should be used for diverging tracks; that it is a most dangerous and reprehensible practice to displace or disconnect any part of safety appliances, such as detector bar, switches, switch locks, machine interlocking, except in cases of absolute necessity, and then only temporarily and under proper protective conditions, such as padlocking the switches affected, issuance of caution, notice and employment of flagmen at the positions of danger; that all ground connections should be well drained and all the appliances kept clean.

The points on a railroad where the most train movements are found are usually chosen to introduce interlocking signals, but an exception to this rule is found at grade crossings and drawbridges, of which there are so many in this country. Most of the States some years since passed laws compelling railroad companies to bring their trains to a full stop before crossing a drawbridge or a grade crossing. These laws have been found very irksome, not only on account of the cost of an unnecessary stop, but from the delay caused by stopping passenger and heavy freight trains. This has been very clearly pointed out in some of the reports of railroad commissioners.

For a simple grade crossing protected by 4 derailing switches, 4 home and 4 distant signals, the most simple form of interlocking answers every purpose, and great efforts have been made to reduce the cost to as low a figure as possible. It must be remembered, however, that no matter how simple the interlocking, it should be arranged to be perfectly safe under all circumstances, and easy to maintain in good condition so that one man will be able to properly maintain several crossing towers. In the struggle to introduce cheap appliances, too little attention has sometimes been given to a proper factor of safety. There are crossings now being used with the derailing switches worked without a facing point lock or detector bar. This should absolutely be prohibited, as innumerable wrecks have occurred through the throwing of a switch under a train, and one of the most disastrous accidents that ever occurred was caused in this manner, before, however, the facing point lock was in general use. It must not be forgotten that a derailing switch is a facing switch, which ought to be avoided as much as possible consistent with proper handling of traffic. One of the first conditions, then, in connection with derailing switches should be to make it impossible to give a clear signal with the switch open or partially open. With ordinary interlocking this is improbable, but not impossible. The only absolutely certain method is by working the signal by means of the last movement of the plunger of facing point lock. A switch detector, however, worked by the home signal connection, may well be accepted as sufficiently certain, but without this a crossing should not be considered absolutely safe. In this connection we may consider the working of switches and locks by two lines of wire, which is far less costly than pipe, but which is open to objections that should be clearly stated and understood. It has been demonstrated that switches and locks can be worked by means of continuous wire, and they are certainly easier for the operator. But it is equally certain that perfect means have not yet been found to automatically counteract the effects of the stretching of the wires caused by varying strains. Adjusting screws are furnished and answer perfectly well when handled by competent men, but just at those places where wire-working switches are likely to be used, competent repair and maintenance men are least likely to be found. While, therefore, we are prepared to connect switches by wire, and have the most perfect appliances in the field for so doing, we recommend the pipe connections solely because they are more easily kept in order. The wire-working can be made perfectly safe, except that, when from any cause they become too slack to throw the switch, the operator is usually not sufficiently skilled to know how to tighten them to do their proper work. A passenger train may be standing waiting for the signal which the operator is unable to lower, owing to the imperfect action of the switch. He becomes excited, and instead of going to the switch to ascertain the trouble, he will wave his lantern for the engineman to come ahead, which the latter will frequently do, and so derail his train. This has happened several times.

A great many efforts have been made to work and lock a switch by means of one lever, and various devices are in existence for accomplishing that purpose. We believe we have the only movement that does the work perfectly and in a thoroughly satisfactory manner. We have accomplished this by giving a long initial stroke to the pipe connection, which thereby reduces the power of the operator for rupturing them by giving him less leverage. At the same time, by using our anti-friction pipe carriers, the force required to move the connection is much lessened, and finally the switch and lock movement itself is so designed as to give the minimum of resistance in its proper work, and the maximum for rupture. With this device we claim that switches can be worked with greater facility than those having a separate lock lever, and as safely. When a connection becomes broken the operator knows it through his switch detector, which prevents the signal from being lowered unless the switch is properly home.

Our devices for working signals and switches from the center of a drawbridge are now so complete, that not only do we obtain as perfect working as from ordinary towers, but no trouble is experienced from the changing position of the draw due to expansion and contraction, and the movement caused by passing trains. It very frequently happens that switches are located near the end of a drawbridge, and the use of a machine fixed in the center of the draw and worked by the draw tender saves the expense of switchmen at one or both ends of the draw. It is very essential, however, that the connections be so arranged as to require little adjustment and be easily kept in good order. Due allowance should also be made for the jarring to bridge couplers, caused by trains passing on and off the bridge. All these requirements are met by the appliances furnished in our system.

SOME SNOW PLOW TRIALS.

A fruitful source of danger to trains is the misplaced switch which is continually causing disaster, and which can almost invariably be avoided by the use of distant switch signals. It is absolutely certain that, with facing switches unprotected by a signal, these accidents will continue to happen in the future, as they have done in the past. It is not an expensive matter to have these signals, and they can be arranged to be fixed in connection with any kind of switch stand. We have been unable in this issue of our catalogue to illustrate distant switch signals.

For roads not having sufficient traffic to warrant the use of distant switch signals we can furnish padlocks for the ordinary switch levers so arranged that the switchman cannot take out the key of the padlock until the switch is set and locked for the main track. For switches also that are too far from a tower to be conveniently worked, we have a key locking arrangement, by means of which a key must be taken from the tower to open the outlying switch, and until the key is brought back to the tower no signal can be given for a train to proceed in the direction of the switch, and of course the key cannot be brought back until the switch is set and locked for the main track. This method is a slow, but very safe arrangement.

It very frequently happens that a signal tower is located at or near a street crossing, in which case it is decided economy to work the gates from the tower, and they may be interlocked with the signals or not, as may be found most desirable. This is very often found much more convenient, as well as safer, than having a separate man on the ground, who is liable to raise or lower his gates at the wrong moment, and besides, cannot see approaching trains so well as the man in an elevated tower. The ordinary lifting gates may be used, or swinging gates which close against the street in one position, and against the railroad in the other, so preventing cattle, etc., from getting onto the railroad when being driven over the crossing.

Various devices are in use for notifying enginemen of the position of signals during foggy weather. The most usual method of doing this is to place men at the signals with torpedoes, which they fasten to the rails according to the position of the signal. Unless this is done, or some automatic system used, trains will necessarily be delayed. So far as we know, nothing has yet been put into service that gives complete satisfaction, although numerous inventions have been made.

It is the custom in France to attach a torpedo to each home signal, so arranged that when the signal is at "danger" the torpedo is on the track, and when the signal is at "clear," the torpedo is withdrawn clear of the track, so that only when an engine or train runs past the signal at danger is the torpedo exploded. It is often important to know if an engineman has overrun his signal, and this will give some indication, but not certain evidence, as there is nothing to prevent an operator throwing his signal to "danger" during the passage of a train, and so putting the torpedo on the track in front of the wheels.

The Palmer torpedo signal is in use to some extent, and has given, so far as we know, general satisfaction. It works with the home signal as described above, but the instrument is arranged to hold five torpedoes, and when one is exploded another takes its place until the five are exhausted, when the box has to be filled again.

Some efforts have recently been made to introduce an illuminated blade for signals, so as to show a night signal as near as possible like the day signal, but so far these efforts have not been very successful. The idea of illuminating the blade is quite an old one, and has been extensively tried, but never with enough success to displace the usual lamp showing red for "danger" and white for "all clear." Notwithstanding that some objections can be raised to this method of night signaling, the fact remains that if accidents do occur through its use they rarely or never come to light, and tens of thousands of these signals are in service and have been for years.

It is quite probable that, could equally good results have been obtained by colors for day signals, color instead of position would in all probability have been chosen. With a sky background the position signal by day shows perfectly, but unfortunately we cannot always obtain a sky background, so that it is impossible to give an equally good signal for all places. Ordinary observation will convince any one that a day signal may much more easily be passed unobserved than a night signal. The improvement needed, then, is not in night, but in day signals.

In considering the question of position signals for night, we need to be careful not to be allured into its adoption for the sake of conforming to the principle adopted for day signals. It is quite reasonable to have one principle for day and another for night; and unless it can be shown that there are important grounds for change other than mere uniformity, it would seem to be undesirable to make a new departure from an old established system which has worked so well in the past.

What are the advantages to be gained by introducing illuminated blades instead of the different colored lights, that would warrant railroad companies to depart from present usage? They perhaps are more distinctive, but certainly are not so arrestive as a strong light through a good red lens.

Are they less expensive in first cost or to maintain? On the contrary, in both they will exceed the present methods. Will they retain the same uniform state of illumination? No; they are more liable to derangement, and more difficult to keep from becoming dim and obscure. Are they more desirable because of color blindness? No; color blindness can readily be detected, and precaution should be taken to remove men from a position they are unfitted for.

Trains carry colored lights in their rear, and the misunderstanding of such would lead to accidents.

It may be said that their chief advantage lies in the fact that they differ from other lights about cities, more than the old systems.

Let us examine this. What is there in it? On the surface it is striking. Are not enginemen conversant with the road they run over? Do they not know the location of all their signals, and can a light be added to or taken from the systems through which they pass without being detected by them? If so, we are in a sorry plight, because neither system gives us security. Lights may be extinguished, and the rule which says, "*The absence of a signal where there should be one must be taken as a danger signal*" presupposes knowledge of the positions of all signals which govern the movements of the enginemen, and if one fails to observe the absence of a signal where there should be one, great risk is certainly incurred. Where is the danger in additional lights along the route, either transitory or fixed? If of the same color as the railroad's safety light it can only be misleading through the extinction of the proper signal light and occupying its position. If of the same color as the railroad's danger signal the worst that could happen would be slight delay. The idea of street lights being mistaken for signal lights by a railroad engineman is far-fetched and imaginary and does not rest upon good grounds.

As the proper working of any kind of mechanism depends to a great extent upon the condition in which it is kept, we furnish a few general rules for maintenance which have received very general approval.

In our mechanical devices we shall endeavor to keep to one standard as much as possible consistent with a due regard for decided improvements.

Snow Plow Battles.

During the past winter the fall of snow in the Rocky and Sierra Nevada Mountains has been something enormous, and every known device for keeping the railway lines clear have had an excellent chance for trial.

On the Central and Southern Pacific early in the winter both the Rotary and the Cyclone plows were in service, and had as large contracts as it is usually safe to take with snow plows of any kind. In this matter of handling snow by machinery the Rotary has the advantage of several years' experience, while the others are comparatively new.

The illustrations here shown are from instantaneous photographs, and are true representations.

Fig. 1 shows a Rotary after it had backed out of a cleared siding at Cascade, Cal. The cut shows the successive layers of snow and ice. The snow at this point was so deep that the top had to be shoveled off in order to give the plow room to throw the snow, it was so deep it was above the chute.

Fig. 5 shows this plow at work in the siding, throwing a solid stream of ice and snow clear over the main track.

Fig. 6 shows the plow at work in the great Cascade cut, and delivering snow on top of a 30 foot embankment.

Fig. 4 shows the cut after it was opened, and gives some idea of the battles the Central Pacific has had with snow. Late in April there was a great contest between the "Rotary" and the "Jull" plows on the Alpine division of the Denver, South Park & Pacific. This line over Alpine pass in the Rocky Mountains is operated only in summer, and had been closed for over four months. The snow was deep and hard, and the many springs in the mountains had flooded the tracks and frozen hard. This was the first great trial of the Jull, and a hard one. The road is narrow gauge, very crooked and very steep, and this plow—which projects 15' 4" ahead of the front axle—was very hard to keep on the track. Much trouble was experienced in getting her over the line 155 miles where there was no snow, and the first round she had with a 8-foot bank left her off the iron, as shown in Fig. 2.

SOME SNOW PLOW TRIALS.

The conical auger seemed to run all right, but the plow could not be kept on the track, and some difficulty was experienced because the plow could not throw the snow on either side of the track without stopping to change a heavy gate at the top, as shown in Fig. 3.

Fig. 7 shows the Rotary making eight miles per hour through four feet of solid snow on this division of the road.

It was unfortunate for the "Jull" that it was not first tried on some straight and level road, instead of on one of the hardest in the country.

The work of the Rotary plows has proven the feasibility of handling snow by machinery, and their excellent work on all the western roads this winter will no doubt still further introduce them.

These cuts and this data were furnished by the Leslie Brothers builders of the Rotary plow.

A Great Brake Trial.

The governments of South Australia will decide upon the adoption of automatic continuous brakes this year, and, to better enable their mechanics to decide on the best, will hold a great public test in September, under the following conditions:

1. Any brake entering into this competition must be continuous and automatic in its action, and capable of being applied by the driver or guard. 2. The engines, tenders and trains shall be similar in all respects. 3. The trains shall consist of not less than fifty vehicles of mixed classes. 4. The trials shall be made on the narrow gauge lines. 5. All engine and tender wheels, except the leading bogie wheels, shall be braked not to exceed 95 per cent. of the working weight on each wheel. 6. All other vehicles in the trains shall be braked with one block to each wheel; the brake block pressure on each wheel not to exceed 100 per cent. of the weight on that wheel when the vehicle is empty. 7. The brake mechanism used in the trials shall be such as is intended for general use. 8. With the exception of the addition of the brake rigging, the standard construction of the government stock shall not be interfered with. 9. Competitors shall design their own brake rigging, and be responsible for the method of application to the stock. 10. The trials shall be made with brake blocks hanging ½ in. from the periphery of the wheel. Tests will afterwards be made with blocks hanging 1 in. from the wheel, in order to show the efficiency of the brake with half-worn blocks. 11. The consumption of coal and water of each engine on trial shall be taken. 12. Each competitor shall be allowed to select his own trainmen from the South Australian Railway service. 13. Each competitor shall be allowed three days' private trial with his train in complete form before the competitive trials take place. 14. Before the trials are made the board must receive a written assurance from each competitor that his train and brake are complete and to his satisfaction. 15. No competitor will be allowed to interfere with, alter or repair his train during the progress of the trials, except with the written permission of the board. 16. The whole cost of fitting up the train shall be borne by the competitors, in accordance with the resolution passed by the house of assembly: "That a board of experts

be appointed to inquire into the respective merits of the Westinghouse, vacuum and other brakes, and practically try the same, if necessary, at the cost of the respective manufacturers or competitors, with a view of recommending which is the most suitable for adoption on the South Australian railways." 17. The brake trials shall take place in the first week in September, 1890. 18. Any persons desiring to compete under these conditions must signify their intention in writing to the board on or before April 30, 1890.

The Great "Tip" Question.

The chairman of the London & Southwestern goes even further than Mr Laing, of the Brighton, in his remarks on this subject to the general meeting of the shareholders, held on the 7th inst.

When questioned by Sir William Vincent as to the notice threatening dismissal to any servants taking gratuities ever being acted on, and asking if even the directors themselves did not tempt the men to transgress the rule, the Hon. Ralph H. Dutton had to admit that the regulation has been withdrawn.

By this admission Mr. Dutton practically admits that his company allows its customers to supplement the unduly low wages of its servants by public charity—for it is nothing more or less, and we shall, probably, in a short time see notices displayed in the stations, "Please remember the porter, he only gets 15s. a week," or, "Kind friends, the booking-clerk has a wife and three children to keep on 18s. per week."

There seems, latterly, to be a tendency arising amongst those who control our railways, to make extra charges for all the comforts and conveniences which have hitherto been considered to be included in the fares charged to their customers, as witness the proposed charge for an electric light by which it is possible to read, on the District Railway. Perhaps we shall hear next that the same company, in conjunction with the Metropolitan, has fitted trains with cylinders containing compressed oxygen, from which by putting a penny in a slot their unfortunate passengers may be enabled to obtain a supply sufficient to travel safely through the suffocating fumes of their ill-ventilated tunnels.

We do not in the slightest degree wish to divert the welcome addition to the wages of the underpaid and overworked railway men afforded by the liberality of the public; but we do think it a mean and despicable action on the part of a body of well-to-do employers to deliberately underpay their servants and leave them to depend upon the charitable contributions of their customers to pay the difference.

Besides this, the taking of "tips" on the part of men is destructive of their self respect Those who are acquainted with the men working on the railways in the United States and the Colonies, know that the offer of a "tip" would be taken as an insult, and might possibly be followed by a knock down blow from the indignant conductor or baggage man

Why should not the same independent spirit exist on our railways? The answer comes promptly, "Because the pay of the men is not sufficient to support them."

The question then arises as to how the present system is to be altered, and we reply, by paying the men fair wages for their work. "But," it will be argued by railway managers and others who want all the plunder for themselves, "the companies can't afford it." "Then," we would reply, "charge higher fares", the public would be as willing to pay a small extra charge to the company as to tip the servants, provided that they were sure that the latter duly reaped his proper share of the money.

The fact is that our railway companies are one and all seeking to give the least amount of service to the public for the greatest amount of money, and at the same time extorting the greatest possible amount of labor from their servants for the smallest possible remuneration.—*R'y Herald* (*Eng.*)

[So far as we know, conductors of trains in this country do not take "tips," and train baggage men seldom get the chance, but baggage men and porters at large stations not only get them, but ask for them; at some of the North River ferry-houses in this city the porters will ask for a tip before they take a trunk off a carriage boot. Not long ago a baggage porter at the Grand Central station put a trunk on a carriage for us, and stepped to the door saying, "Can't you give me something for handling your trunk, sir, *I get no salary.*" This, of course, was not true, but the tip was wanted just the same. Porters on our Pullman sleepers receive but $15 per month, make long trips of from four to ten days away from home, and—live on tips The tip business is growing in this country; it is degrading to the service, and ought to be stopped, and the cause and the remedy are plainly stated by our English contemporary above. We are sincerely sorry there is not as much of the insult and knock-down business here as our friends across the pond give us credit for.]

Quite a Change of Officials.

On the first of June Geo. W. Cushing resigned his position as supt. of motive power of the U. P., and was succeeded by Harvey Middleton, of the Santa Fe. John Player, of the Wis. Central, takes Mr. Middleton's place. Mr. Player's successor has not yet been named.

SOME SNOW PLOW TRIALS.

Pedrick & Ayer, of Philadelphia, have issued a neat catalogue of the Richards open side planer, the manufacture of which they have recently undertaken; this is one of the most ingenious and convenient tools devised in recent years for planing iron, a very small machine doing very large work, the tool traveling and the work standing still; anything that can be got up beside the tool can be operated upon. The circular shows the tool at work on numerous difficult planer jobs.

They Lead the Procession.

Horace Lovering, of the Maine Central, has sent in a list of 160 subscribers, the largest club of the year so far. Geo. McCombs, of the Duluth, South Shore & Atlantic, is a good second, with 143 to his credit. Both say they are not through yet.

The first of a series of articles on Heat, Motion and Work, and their Units of Measurements, which appears on another page, will be found of engrossing interest to all who have to do with the steam engine in any form. The articles are extracts from a paper read by Mr. Hemenway before an engineer's club in this city. The facts are stated in such an interesting way, and the illustrations are clothed in such plain raiment, that any engineman can understand them. Mr. Hemenway has the reputation of being one of the best steam engineers in America; he came up from the ranks, and knows how to explain mechanical subjects for the masses. Read the articles.

The estate of F W. Richardson, Troy, N. Y., have recently issued a very neat and complete catalogue of their balanced valves, relief valves, valve springs, valve motion models, etc. The catalogue contains a great deal of information about balanced valves. We notice that they are now branding all valves made by them as "made only by estate of F. W. Richardson," this being done to get rid of bearing the blame for failure of many mongrel balanced valves that are called Richardson.

Send us notices of promotions and appointments of enginemen or machinists to foremanships, traveling engineer, master mechanic or engine dispatcher positions. This paper tries to aid its patrons to rise in their profession, and knows of no better way to help them than to record their successes in that line. Promotions from the left to the right side we count as a matter of course, if we tried to record them, there would be little else in the paper

There are still in use on the Bristol & Exeter Ry., in England, two of the Pearson express locomotives, built in 1867, having a single pair of drives nine feet two inches in diameter They are said to have made ninety miles per hour.

George Francis Train has just completed a trip around the world in 67 days, 13 hours, 3 minutes, and 3 seconds, not counting a 24 hour stop in New York. He says he can make it in 48 days, and will try it in October. So much for steam.

The Richmond Cedar Works of Richmond, Va., intend to change their pole road track to iron or steel, and want about 12 miles of thirty to thirty-five pound rails, old or new. Also engine and cars, narrow or standard gauge.

One of the most interesting things a man can keep is his time books or stubs of trip slips. History thus compiled day by day is worth looking over long years after.

A man is under indictment in England for stopping a Great Eastern express train between stations to get on. In this country he would be elected a director.

Wm. H. Miller has been appointed Master Mechanic of the Columbus, Hocking Valley & Toledo Ry., in place of J. S. Patterson, resigned.

We will pay five dollars for a copy of the sixth annual report of the Master Mechanics Association. Who has one to spare?

There were 30,038 tons less steel rails made in England last year than the year before.

There is a locomotive on the London & Northwestern road that makes 800 miles per day; she is run by three crews.

President M. E. Ingalls, of the Chesapeake & Ohio Ry., will deliver the opening address at the Master Mechanics' Association on the 17th.

It is some days since anything abnormal in the locomotive line has come forward. As the barber says—next.

Last year there were 1,139 people killed, and 10,981 injured by railroad accidents in Great Britain.

CAST STEEL WORKS of FRIED. KRUPP, ESSEN, Germany.

Represented by THOMAS PROSSER & SON, 15 GOLD ST., NEW YORK.

These works cover an area of 1,200 acres, employ about 18,000 men, have the most improved plant, and stand unique, from the fact that they have their own Ore and Coal Mines, Blast Furnaces, etc., and that *every* stage of manufacture is under their own supervision, and are not (like others) dependent on the open market for a miscellaneous assortment of crude material; which, in connection with 75 years' experience, enables them to turn out a product of a very superior quality, second to none, and at the same time the different grades of Steel are always of the *same uniform* quality.

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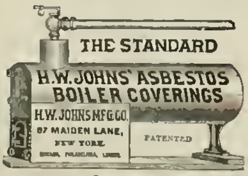

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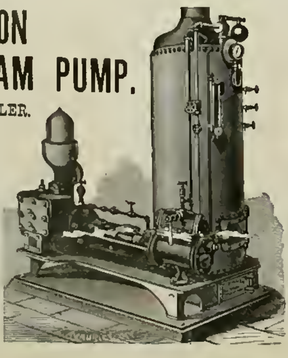

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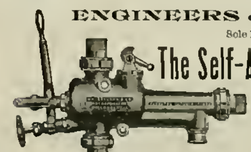

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No service on a locomotive sufficiently severe to permanently stop its working.

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Very easily operated—Started by pulling out the lever, and stopped by pushing the lever in. Descriptive Circular & Price List sent on application to Office & Works,

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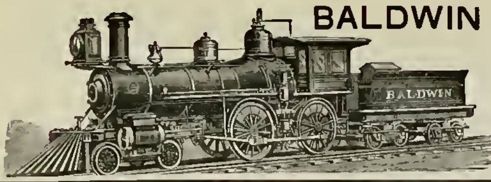
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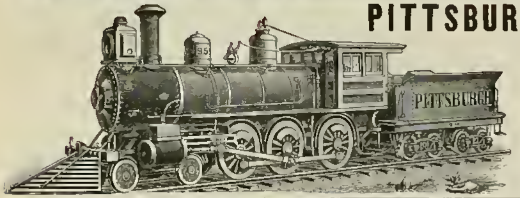
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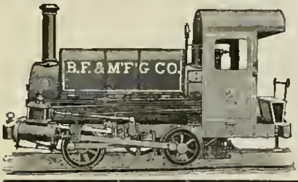
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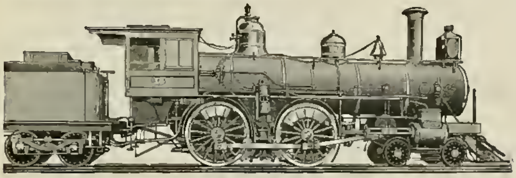


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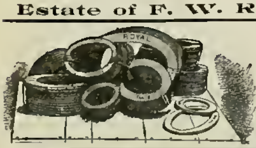
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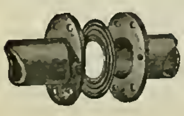


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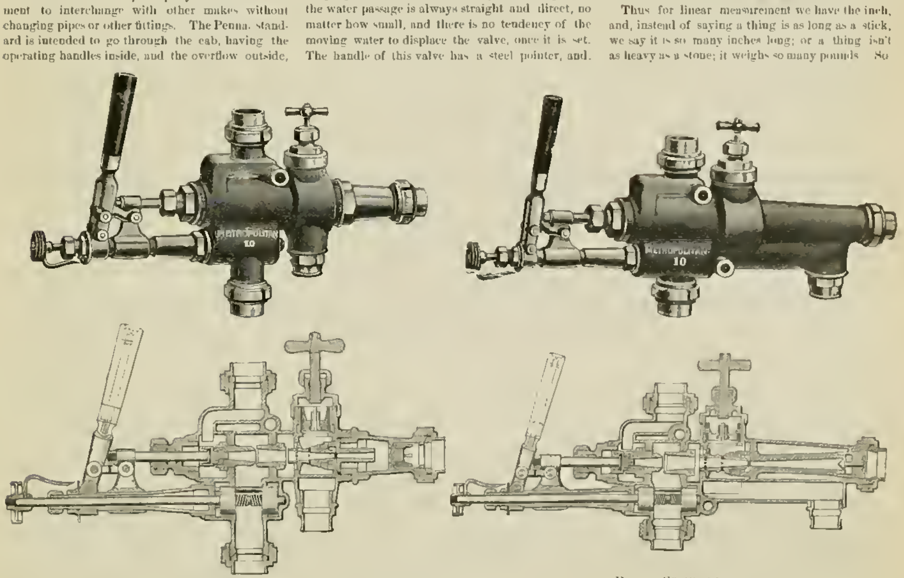
VOL. III, NO. 7. NEW YORK, JULY, 1890. $1.00 per Year or 10c. a copy.

The Metropolitan, Re-starting, Locomotive Injector.

The accompanying engravings illustrate a new re-starting injector recently placed on the market by the Hayden & Derby Manufacturing Co., of 111 Liberty street, New York City.

The two styles are alike, except in length, and this difference is made principally to suit the instrument to interchange with other makes without changing pipes or other fittings. The Penna. standard is intended to go through the cab, having the operating handles inside, and the overflow outside, end of the body, which prevents the paint from being burned off the injector, and makes it much easier to keep clean.

The water valve or "lazy-cock" is of an entirely new design, as is plainly shown in the sectional view, the stem terminates in a right and left-hand screw, and when it is revolved it moves two cylindrical plugs to or from each other, by this arrangement the water passage is always straight and direct, no matter how small, and there is no tendency of the moving water to displace the valve, once it is set. The handle of this valve has a steel pointer, and.



N. Y. STANDARD. METROPOLITAN INJECTOR. PENNA. STANDARD.

while the N. Y. standard is intended for use where the overflow pipe is wanted inside.

There is no primer or small starting valve of any kind, nor is it necessary to operate the starting lever slowly to prime the instrument; when it is desired to start the injector, the lever is pulled wide open, and the instrument will go to work at once, and will automatically re start—as soon as working conditions are restored—if the water splashes away from the feed hose or the injector "breaks" from any other cause. The instrument is made of brass and bronze, except the long guide for the cross-head, that also carries through its center the spindle of the water-regulating valve, which is made of malleable iron, and the handles, which are of hard rubber. The water passage is very direct and large, and the steam is introduced at the extreme back by use of a series of marks on the guide, the runner can adjust the valve very closely, and keep it in one place, the handle, coming back as it does, makes it very easy of access. The overflow valve is large, and has its guides or wings in a chamber above the seat, is easy of access, easy to grind in, and too large to wear much in service

Special pains have been taken to make the tubes removable for repairs, no matter how bad the water is. The seat and valve of the main steam valve, or ram, are made of nickel, are hard, will not corrode or stick together, and wear much less than brass.

The manufacturers of this injector have been something like a year testing it, and overcoming defects, it is now in use on the Central Railroad of N. J., giving good satisfaction.

Heat, Motion and Work, and their Units of Measurement.

BY F. F. HEMENWAY

SECOND PAPER.

In order to measure things we must have

UNITS OF MEASUREMENT

Thus for linear measurement we have the inch, and, instead of saying a thing is as long as a stick, we say it is so many inches long; or a thing isn't as heavy as a stone; it weighs so many pounds So when the mechanical theory of heat was accepted, it was necessary to establish a unit by the use of which quantities of heat could be measured. The thermometer measures the quality—that is, the intensity of the heat—but not the quantity Here again, water is the best medium, and the

UNIT OF HEAT

was fixed as the quantity of heat that will increase the temperature of one pound of water by one degree, the water being at a temperature just above freezing. The reason why the temperature of the water is fixed—Rankine makes it 39.1—is because the quantity of heat varies slightly at different temperatures. But the variation is so slight as under ordinary circumstances to be of little importance The most we care for now is to understand what a unit of heat really is. A pound of water is a definite—a measurable quantity—so is a degree on the Fahrenheit scale; then, although we cannot handle a unit of heat, it is still, by comparison, a definite quantity.

THE UNIT OF WORK.

The unit of work is the foot-pound; it is the amount—the quantity—of work required to lift a weight of one pound to a height of one foot against the force of gravity. This unit is used to measure motion in any direction against resistance. Now it will be readily understood that, to make the knowledge of heat readily available for calculations, it was necessary to establish the exact relation between the unit of heat and the unit of work, and after much experiment it was found that one unit of heat was equal to 772 units of work.

This is something worth thinking about. We can afford to give it a little more attention, even at the expense of recapitulation, let us do so. A unit of heat is the *quantity* of heat required to raise the temperature of one pound of water one degree. By comparison we can get a fair idea of this quantity without being able to see it. A pound of water is—near enough for present purposes—one pint; not a very large quantity. And a difference in temperature of one degree in this water is not appreciable to the touch. If you took this pint of water at a temperature of 30, you could hardly put your hand in it and remove it without increasing its temperature by one degree. Put the water in a tin basin and burn a match under it, and you might increase its temperature one degree. A pound of coal is a small lump, yet it is capable of yielding from 12,000 to 14,000 units of heat. From the foregoing we can see that a unit of heat is a very small quantity indeed. Yet if all this heat was usefully expended in doing work it would raise a weight of one pound to a height of 772 feet, or a weight of 772 pounds to a height of one foot. This 772 foot-pounds is called the mechanical equivalent of heat. What this really means is that one unit of heat will perform 772 units of work.

ENERGY.

Energy, in mechanics, is the capacity for doing work, and is usually considered as divided into two kinds, viz. Kinetic, or actual energy, and potential, or possible energy. If a body is moving at a given velocity it possesses actual energy, and the amount of this may be determined by a consideration of its weight and velocity. For example, a cannon ball of a given weight projected at a given velocity, possesses a definite amount of actual energy, because it will do a definite amount of work in being brought to rest. The fly-wheel of a steam engine contains actual energy because it will do work in being stopped, or in having its motion reduced.

Potential energy is the possibility of doing work possessed by a body. Thus, if the same cannon ball were carried from the ground to the top of a building, it would possess potential energy with reference to the ground, because it would do work in falling.

ENERGY OF COAL.

Coal, which is the most common fuel in use, possesses the possibility of heat, and heat is motion of one kind. According to strict definition it would not, perhaps, be correct to say that coal possessed potential energy, still, if one were to say this were so, it would not be easy to successfully dispute the statement. To return to the cannon ball, its potential energy is due to the fact that it has been carried away from the ground, in carrying it away work has been done, and, of course, heat has been expended. When we let it fall it will render an exact equivalent for the work done in raising it. The cannon ball lies inert at the top of the building, but if we release it, it falls to the ground, and in falling does the work that has been done in raising it.

Now take a lump of coal weighing, say, one pound. It is before us inert, but, like the cannon ball at the top of the building, it possesses the possibility of producing heat, which heat may in turn be converted into motion against resistance. The action of the sun—the heat—has gone on for years storing up possibility of energy in this lump of coal; carrying the cannon ball to the top of the building stored up the possibility of energy in it.

COMBUSTION.

We liberate the heat stored up in the coal by combustion, which is a chemical combination productive of heat. There is a material difference between a chemical combination of substances and a simple mechanical mixture of substances. Thus the two gases, oxygen and nitrogen, unite, mechanically, to form air, and in air we find without difficulty the properties pertaining to both these gases. Substances unite chemically when they have affinity—that is, chemical attraction—one for the other, and the result is a compound entirely unlike either of the substances entering into the combination. Certain substances, each harmless in itself, may chemically combine to form a high explosive or a deadly poison.

In all chemical combination heat is evolved, but the combination may be so slow that the heat is not noticeable. But in combustion, as we speak of it in burning coal, the combination is rapid, and the heat evolved is correspondingly intense. This combination is that of oxygen and the combustible matter of the coal, which is largely carbon. The heat resulting from combustion is believed to be due to the violent clashing together of the atoms of the combustible matter and the atoms of oxygen, in their intense efforts to unite.

The chief constituents of coal are carbon and hydrogen. What is called a pure anthracite coal contains about 92 per cent. carbon, 2 per cent. hydrogen, 1 per cent. oxygen, 2 per cent. water and 3 per cent. ash; and, since carbon predominates—in fact, forms nearly all the combustible in the coal—we may for present purposes consider all the combustible matter as carbon. It has been experimentally determined that the combustion of a pound of pure carbon will yield 14,500 heat units, and as the combustion of hydrogen, weight for weight, yields rather more than four and a fourth times as much heat as the combustion of carbon, we may conclude that a pound of the purest obtainable anthracite coal will yield 14,500 heat units. Let us put it at 14,000. The problem that concerns you as engineers and firemen is how to set this heat free, and how best to utilize it in moving the piston of the engine back and forth in its travel.

It will be interesting to think of the equivalent in mechanical work of this little lump of coal. It contains 14,000 heat units, each equivalent to 772 units of work, altogether $14,000 \times 772 = 10,808,000$ feet that the heat of this small piece of coal would lift a weight equal to its own if all the heat it contained could be applied to that purpose; this is more than 2,000 miles. It seems almost incredible, yet it is no more than the realization of the full mechanical equivalent of the heat in the coal.

Let us see what work we get from this coal in actual practice. In steam plants as they go, and in every-day practice, if we get a horse-power on the consumption of two and a half pounds of coal per hour, the result is considered very good. Some plants may be doing as well as this, but very few better, and many worse. Now let us take this same one pound weight and use an engine requiring two and a half pounds of coal per horse-power per hour to raising it to a height of 2,000 miles, or equivalent work. Suppose we raise this weight to a height of 2,000 miles in one hour of time. A horse-power will raise 33,000 pounds one foot high in one minute, so it will raise 1,980,000 in one hour. Dividing 10,808,000—the number of feet in 2,000 miles—by this, shows us that it would require five and a half horse-power exerted for one hour to raise this pound weight to a height of 2,000 miles. At two and a half pounds of coal per horse-power there would be required thirteen and three-quarter pounds of coal to do what work there is heat enough in one pound to do. In this instance, viz.: with an engine using two and a half pounds of coal per horse-power per hour, between 7 and 8 per cent. of the total heat efficiency of the coal is utilized. It will readily be understood that with the largest and most efficient of steam engines—those doing a horse-power on about one and a quarter pounds of coal—the greater part of the heat goes to waste.

HOW LOSSES OCCUR.

In order to save it is necessary to consider how losses occur. Let us start first at the boiler. Combustion, as we have seen, is a chemical combination of combustible matter and oxygen. In chemical combinations definite quantities unite. If too much of one substance is present the surplus is rejected. In the combination of carbon and oxygen, called combustion, one pound of carbon unites with two and two-third pounds of oxygen, the result being carbonic acid gas. Air is composed of the two gases, oxygen and nitrogen, nitrogen largely predominating, so that, to get the two and two-third pounds of oxygen required, we must have about twelve pounds of air. This is assuming that all the oxygen is utilized. In practice this is not the case, so that it is necessary to supply about twenty-four pounds of air to the furnace for every pound of coal burned. Not only is the oxygen we use largely diluted with the nitrogen, that is of no use in supporting combustion, but we admit about twice as much air as we use the oxygen from. The nitrogen is inert, but its presence is necessary to dilute the oxygen. We know that the gases as they enter the chimney are hot, as we use the term, and that all the heat they carry away to the chimney must come from the coal. Hence we can readily see that all this surplus air that goes through the furnace, and the nitrogen of the air from which the oxygen has been used, carry away part of the heat of the coal, heat we are trying to utilize as motive power. There is loss here—in part necessary loss, and generally in part unnecessary loss. Let us see what this loss is.

The Boyden Air-brake.

One of the most interesting exhibits at the Master Mechanics' Convention was that of the Boyden air brake. This company had a complete equipment in operation, the engine attachments, including driver brakes, and ten complete brakes. In the Boyden the driver brakes are worked "straight" air while the train is automatic, or the driver brakes can be operated automatic with the train, or left inoperative, or the driver brake can be held on while train brakes are being re-charged. The general plan of the brake is not far different from the Westinghouse, the air is supplied by a pump—a very neat and simple one, by the way—is stored in a large drum, and the cylinders, auxiliary drums, pipe and hose connections are very like, if not exactly like, the Westinghouse.

The quick-action triple valve is altogether different, but similar in action. The brake, as shown in this equipment at least, is very much quicker both in application and release, it being possible to recharge the auxiliaries before the air is exhausted from the cylinders.

The engineer's valve is a large 3-way cock, and all the positions for the different combinations of the combined straight and automatic are made by ports in the plug of the valve.

The train brake cannot be changed from automatic, and is entirely interchangeable with the Westinghouse. It is in use on the B. & O.

A testing machine, just completed by the Phenix Iron Co., of Phenixville, Pa., is said to be the largest ever built. It is designed to test full size bridge members up to 55 feet in length, and to strains up to 2,000,000 pounds, either in tension or compression. Water pressure of 720 pounds per square inch is applied to a cylinder 5 feet 6 inches in diameter and 5 feet stroke. The general style of construction is similar to the machine at the Union Bridge Works at Athens, Pa. The cylinder is cast steel, and without the heads weighs 28,000 pounds; the other parts, crossheads, etc., are correspondingly massive.

The Rogers Locomotive Works are very busy on large orders. The Central of N. J. have just received from them several more for their fast express runs; these are 19 x 24, 8 wheelers, weighing upward of 100,000 pounds.

Editor J. N. Corbin, of the *Union Pacific Employes' Magazine*, Denver, Col., was a welcome caller at our den this month.

The B. & O. have ordered 1,000 box and 2,000 coal cars, the box cars to be equipped with air-brakes.

An Old Knight of the Drop Hook.

Some time ago John Brunton, of Pueblo, Col., asked through this paper if there were still alive any of the other engineers who were delegates to the Baltimore Convention, Knights of the Footboard, in 1855. He sends us an interesting letter, an outline of which we print below

"... I saw in THE LOCOMOTIVE ENGINEER your name as one of the delegates to the Baltimore Convention. I was one of the delegates sent from the Camden & Amboy R. R., and resided at South Amboy, N. J., then, as now. I have been continually employed since July 1, 1842, first as fireman, then engineer, up to 1863, then as roundhouse foreman, in which capacity I am still employed.... James R. Smith, now of Newark, N. J., was a delegate from the N. J. R. R. and Transportation Co. I have railroaded now 48 years; we have but one man still in the service who is older, Geo. Vernon, who has been at it for 51 years.... I fired the John Bull in 1842, the first locomotive in the State of N. J. I afterward ran her at different times. I had the honor to run the special that carried the Prince of Wales over the C. & A. road, and ran the engine that carried the last President's message that was taken to N. Y. in that way before the final adoption of the telegraph. I was one of the first to run a locomotive burning hard coal successfully; the engine had a single driver eight feet in diameter. I ran this engine three years without a blower.... I was sent to the Chicago Exposition of Railway Appliances in 1883 to run the John Bull around the grounds—she was the oldest locomotive in the world, capable of holding steam, having been built by Stephenson in 1831."

JOHN SEXTON.

The Johnston Electric Train Signal Co. have put up a new factory at Woburn, Mass. They will make other electrical devices beside their train signal.

Railway Accident Statistics.

The following statement for the year ending June 30, 1889, was compiled in the office of the statistician to the Inter-state Commerce Commission, and presented to the National Convention of Railroad Commissioners in Washington, May 28, 1890:

The figures given below make an exhibit of the number killed and injured under the three heads: "employes," "passengers" and "other persons." They further show the classes of accidents, and the loss of life and injury to persons resulting from each. A summary of these facts is given in the table which follows:

RAILWAY ACCIDENTS FOR THE YEAR ENDING JUNE 30, 1889.

KIND OF ACCIDENT.	EMPLOYES Killed	EMPLOYES Injured	PASSENGERS Killed	PASSENGERS Injured	OTHER PERSONS Killed	OTHER PERSONS Injured	TOTAL Killed	TOTAL Injured
Coupling and uncoupling cars.	300	6,757		...	...	.	300	6,757
Falling from trains and engines	493	2,011		.	.		493	2,011
Overhead obstructions..	65	296			.	..	65	296
Collisions.	167	820	107	145	37	48	311	1,313
Derailments	125	655	28	389	29	69	182	1,113
Other train accidents	189	1,016	26	247	522	515	737	1,778
At highway crossings	24	45	3	10	110	634	137	695
At stations	70	690	26	296	228	472	324	1,166
Other causes	630	7,729	130	754	2,915	2,397	3,671	10,880
Total .	1,972	20,028	310	2,146	3,541	4,135	5,823	26,309

The railways of the United States carried 472,171,343 passengers during the year covered by this statement, from which it appears that one passenger in every 1,523,133 was killed, and one passenger in every 220,024 was injured. For the year 1888 the rate of casualty in England to passengers from railway accidents was one passenger in 6,942,336 killed, and one passenger in 527,577 injured. In judging of the above figures it should be noted that passenger mileage for a given number of tickets sold is much greater in the United States than in England, a fact which mitigates somewhat the severity of judgment upon railway management in the United States disclosed in the above comparison.

In order to appreciate the above exhibit of casualties to employes of railways, it is necessary to know the number of employes liable to the various sorts of accidents recorded. The total number of railway employes in the United States is 704,736, which, for the present purpose, may be divided into trainmen, switchmen, flagmen and watchmen, and other employes. The number of employes in each class, as also the casualties to each class, is given in the following statement:

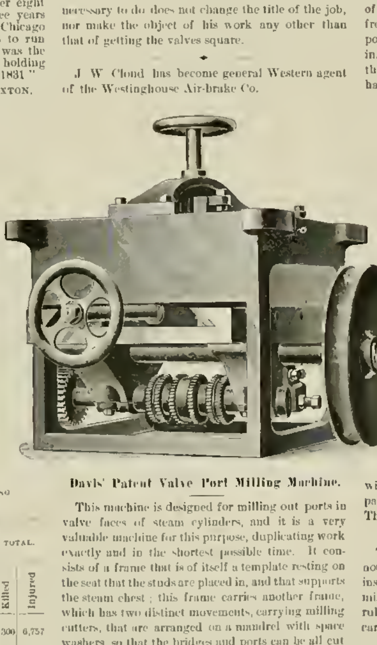
CASUALTIES TO EMPLOYES.

Class of employes.	Number	Killed.	Injured.
Trainmen	137 334	1,179	11,301
Switchmen, flagmen and watchmen	38,344	229	2 155
Other employes	517,820	536	6,360
Unclassified	16,238	28	214
	704,736	1,972	20,030

—*Ry. Age.*

Squaring valves, setting valves, and running them over all mean the same thing exactly. When a mechanic is sent to do this work he may only have to move a blade on the strap, or he may have to move all the eccentrics—what he finds it necessary to do does not change the title of the job, nor make the object of his work any other than that of getting the valves square.

J. W. Cloud has become general Western agent of the Westinghouse Air-brake Co.



Davis' Patent Valve Port Milling Machine.

This machine is designed for milling out ports in valve faces of steam cylinders, and it is a very valuable machine for this purpose, duplicating work exactly and in the shortest possible time. It consists of a frame that is of itself a template resting on the seat that the studs are placed in, and that supports the steam chest; this frame carries another frame, which has two distinct movements, carrying milling cutters, that are arranged on a mandrel with space washers, so that the bridges and ports can be all cut to dimensions at one operation; the inner frame is fed down into the cut by the hand-wheel and screw shown on top, and is fed the length of the ports by the hand-wheel at the end of machine. It is operated by a rope belt similar to that used for driving drills, etc. The machine is much lighter than the cylinder, and can be readily placed in position, using the stud holes to attach to, for that purpose. Built by Pedrick & Ayer, 1001 and 1003 Hamilton street, Philadelphia, Pa.

George W. Cushing, lately superintendent of motive power of the Union Pacific, has located in Chicago, his address being box 336. Mr. Cushing does not intend to quit railroading just yet, and will enter the field when suitable opportunity offers.

The popularity of the little book on "Air-brake Practice," by J. E. Phelan, cannot be explained better than by stating the fact that the first edition of 2,000 has been exhausted, and a second edition is now in press.

A Cheap and Handy Latch for Baggage and Express Car Doors.

On the large side doors of express and baggage cars on the Old Colony road they use a very neat and cheap fastening or latch. Bolted flat against the inside of the door there is a steel spring, about two inches of which terminates in a hook that closes over a strip secured to the frame; this catch has a curved end that allows the hook to ride over the strip in closing. Over this spring catch is a plain curved handle, such as used for a thumb latch on doors; this is hung on single rivets, up and down, that allow the handle to move or swing an inch or so. One of the ends of this handle has a projection that extends out under the spring at right angles to the handle, and when the handle is pulled to open the door, this projection swings up and pulls the spring catch out of the plate on the frame.

The whole thing is cheap and substantial

Filling "A Long-felt Want."

The average man has wrestled with the problem of carrying postage stamps without having them, from innate perversity, glue themselves to his pocket-book, or whatever receptacle he places them in. But his wrestling has been unsuccessful. Now the Mason Regulator Company, of Boston, Mass., has stepped into the breach and issued a neat little case, by the use of which stamps can be carried in a pocket-book with the assurance that a fellow can find one loose when he wants it. By enclosing a postage stamp to the company, the case can be had by anybody.—*American Machinist.*

We have one of the books, but the long-felt want is still empty—want stamps to put into it.

On the C. & O. road a great many castings are plainly marked with the pattern number, size in inches, and weight. A front end door marked in inch-and-a-half letters "No. 301, size 50 in., wt. 345," does not look as neat as a plain door, but it admits of no mistakes in repairs, etc; still in a case like the front door the mark could just as well be inside. The plan would save lots of trouble if used extensively in car repairs.

When the N. Y. C. & H. R. gets through changing the numbers on its locomotives, those numbered below 250 will be switching engines, those from 250 to 700 passenger, and all above that, freight engines. The road owns over 900 locomotives.

The B. & O. have put up one of the popular notices, "No drinking on or off duty—no re-instatement, under any circumstances, after a dismissal on a proved charge of drunkenness." This rule will be pretty general in five years. Will you care?

Francis C. Lowthorp, who recently died at the age of 81 years, is credited with being the inventor of the turntable. He was a civil engineer, and long a resident of Trenton, N. J.

The magnificent instruction car of the Westinghouse Co. has been on the Pacific coast since February, having made 23,000 miles from then till June 1st. It is now in Mexico.

The P. & R. now rate their new 50,000 coal cars as a car, two of the old style eight-wheeled cars, and four of the four-wheeled "jimmies" are now rated as a car.

E. F. C. Davis, lately superintendent of the Reading Coal and Iron Co., has become general manager of the Richmond Locomotive Works.

The Amalgamated Railway employes of Australia are agitating for eight hours.

The Plug Engineer.

When Angus Sinclair first struck a job on a prairie road in Iowa, he was put to stopping and starting an old scrap heap on a branch—in local railroad parlance called "the plug run."

It was not long before the townspeople got the fever from the boys and called it the "plug run." Then the boys abbreviated it to "the plug," and everybody followed. Sinclair was known only as "the engineer of the plug," as were also the other trainmen, each according to his station.

One Sunday evening, our friend Sinclair was out with a party of young people taking in the town—had his best girl along—and they strayed into a church where the colored people were having a revival.

The party of young folks sat quietly in the back seats eating peanuts, until at last the hat was passed, it went around and came back to the earnest old exhorter in charge with but a few sorry pennies, which he emptied on the pulpit, and, leaning over the altar of hope, handed the hat back to one of the deacons, saying, "We has to hab a little mo' dan dat, pass it agin, an' don't forgit de white brudders in de back ro',prehaps da gib sumting."

Again the hat came around, and the embryo secretary of the Master Mechanics Association chipped in a quarter.

When the hat got back to the front, the old dominie picked the quarter out from among the pennies, and holding it up between his thumb and finger said:

"De engineer ob de plug gibs a quarter. Lord bress de engineer ob de plug!"

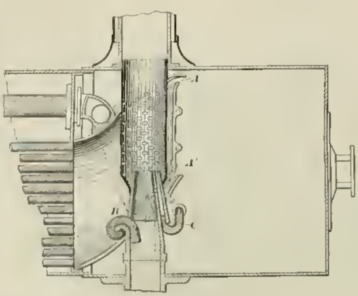


Fig. 1.

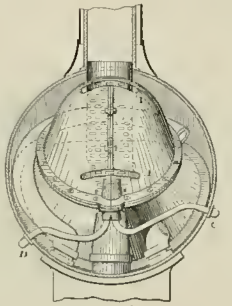


Fig. 2.

HOUSTON'S ARRANGEMENT OF LOCOMOTIVE SMOKE-BOX.

Dead and on Duty.

Engineer Murphy, of the P. & R., was in charge of one of the Wooten fire box express locomotives pulling a West bound passenger train on the Bound Brook line, on the evening of June 3d. In this class of locomotives the fireman is located back of the fire-box, and the engineer ahead. The fireman noticed, when nearly half-way over the division, that the engineer was not making customary signals, and was running at a very high rate of speed, so he climbed over the fire-box to the cab, and found the engineer dead—his head nearly severed from his body. Murphy had been killed by the spout of a water crane—some of these cranes in use on this road not being automatic in returning to position.

Suppose that this fast train should have kept on until it caught a train ahead, crashed into it and killed a lot of passengers. The verdict of the company, the coroner and the public would doubtless have been that the engineer was drunk, or asleep at his post.

The fireman on this engine laid his comrade's body down as best he could, and ran the engine over the road, making all the connections and causing no delay. He was the right man in the right place.

A Little Fuel Test.

Early this month Master Mechanic Van Brunt, of the Pennsylvania & Northwestern Railroad, conducted a ten days' experiment with three new Baldwin consolidation locomotives, to see what effect the Smith exhaust pipe had on the coal pile.

The engines are all alike, haul the same trains over the same track under exactly the same conditions, except that one has Smith's exhaust pipe. The grade is 105 feet per mile for eight miles, all the rest 85 feet per mile.

Engine 18 consumed in ten days 130,700 pounds of coal, and ran 1,105 miles, averaging 118 pounds per mile.

Engine 23 consumed in the same time 113,500 pounds of coal, and ran 1,030 miles, averaging 110 pounds per mile.

Engine 24 (with Smith exhaust) consumed 92,400 pounds of coal, and ran 1,139 miles, or on an average of 82 pounds per mile.

This is a saving of about 30 per cent. of the fuel, and, if anything like it can be maintained the year round, it would pay for a great deal of attention to the pipe.

We have heard lots of good reports from this pipe, and but one complaint—it stops up.

A very small percentage of the fuel burned would pay for cleaning out the pipe two or three times a week. Any nozzle will stop up.

A Joke on the Company Doctor (?).

"Flat-wheel Thornton" runs a train on a big road that has a hospital fund and company doctors.

Flat wheel got his name from a slight limp caused by the use of an artificial limb, though few knew that he wore such a member.

Flat-wheel was "forninst" the hospital fund, and always allowed his monthly deduction for that fund with a bad grace and a hard kick, he never missed an opportunity to declare that the work done by the company doctors was no good, and that the fifty cents off his pay was robbery.

There were lots of other men who thought as "Flat-wheel" did, and finally the company made membership in the hospital scheme voluntary—if you wanted it come and say so, if not, nothing would be taken from your pay. Flat-wheel did not take stock, and had kicked so long that he kept right on kicking, forgetting that he "wasn't in it." One stormy night the switcher ran him down in the yard, and cut off his wooden leg, and the boys took him home. On the way he conceived a revengeful joke on the company doctor; he would send for him, post haste, to amputate his leg—make him earn his money. The doctor was telephoned for, and told to hurry, as Jim Thornton had his leg cut off.

Hastily gathering up his instruments he went to the home of Flat-wheel, who laughed loud and long as he advised Doc. to get an axe and a spoke shave, and make a nice job of it

When pay-day came around the laugh was on Flat wheel—there was a deduction of $25 for professional services of company's physician.

Flat-wheel did get the $25 back, but it cost him $50 for cigars.

Houston's Arrangement of Locomotive Smoke-box.

The device here described is the invention of Chas. Houston, an engineer on the Central Railroad of New Jersey, and is in use on engine 145, belonging to that company. Engineer Houston did not start out to prevent sparks, his idea was to improve the draught enough to admit of the use of a larger nozzle, and thus allow the engine to do more work on a given expenditure of fuel—a subject which enginemen, as a whole, do not worry over much. Houston thought that the many angles and curves that the gases had to pass through to get from the flues, under the diaphragm to the front, through the netting back, and then into the stack, must create friction, and call for a sharper blast up the stack to finally draw them off, than if they traveled in a more direct line. He studied up what little there is known of the laws of induced currents, and found that a continuous jet of steam would move a much greater volume of gas or air through a given orifice than a much larger intermittent blast.

Having secured permission to test his ideas on his own engine, a device similar to the one here shown was put upon the 145, last winter. Experiments developed faults that called for modifications until the present form of front is now used.

A steel hood was made that would cover the flue sheet at one end, and was curved and tapered just enough to fit tight up at the base of the stack, this allowed the gases to travel in the most direct route to the open stack, making no unnecessary crooks and turns

The nozzle stand enters the hood as shown and was at first tried a third higher, but the lower nozzle does much the best.

The perforated sleeve is all the netting there is, and the openings in this are an inch by a quarter of an inch.

At *A* and *A'* there is an opening into the hood for the passage of large sparks; they of course follow the outside of the curve in making the turn. At *B*, Fig. 1, a small pipe enters the nozzle stand and turns around it, directing its jet out of the lower opening at *A'*; this is to throw out such cinders as lodge at the base of stand, and are too large to go out through the screen. At *C* and *D*, Fig. 2, is shown the arrangement of air pump exhaust and blower pipes. They enter an opening in the nozzle stand, and will stay where they are placed—this would be a good thing in any front. Fig 2 is a front view of the device, the front above the nozzle can be taken off for examination, or to clean the nozzle or screen. It will be seen that the steam pipes are entirely outside of the hood, and their leaking will not affect the steaming qualities of the engine.

Engine 145 is an 8 wheeler, 18 x 22, with a 5½ foot wheel, and rather a small boiler; hard coal is used in a fire-box 9 feet long and 36" wide; she originally had a pair of 3" nozzles, and was changed to a single nozzle 3⅞" in diameter; since this device has been used, the nozzle has been opened to 4¼". The engine is on express runs, making 138 miles of fast time every day. One noticeable improvement is the even way the fire burns, being alike all over the box, the engine runs 101 miles without using a poker or slash bar. In May, '89, with standard extension, this engine ran 3,744 miles, using 129 tons of coal; in the same month this year she ran 3,864 miles, using 115 tons of coal, and on one trip daily hauling a five-car train, where last year it was four cars, but it is fair to say that in the meantime the engine has been overhauled. One thing about the device, it can be applied with equal facility to a short or an extension arch—the 145 had an extension and it was left on.

The principle of the device seems good and reasonable, and the inventor has not claimed to save all the fuel and most of the oil; his device is cheaper to make and repair than an extension diaphragm and nettings, and he runs with a larger nozzle doing more work on less fuel

Some Early Valve Motions.

SYSTEM OF TWO FIXED ECCENTRICS.

Two eminent French engineers, Messrs. E. Flachat and J. Petiet, made some experiments with locomotives as early as 1842, and in their report described all the then well-known forms of locomotives in use in European countries. In 1846 their work was translated into English, and a copy of that work is before us as we write. Most of the enginemen of to-day know very little about early valve motions, even so recent a thing as the "hook motion" having become ancient history. All the engines built prior to 1840 were inside connected ones, and the engravings—which were made in 1846—show the throw of the crank. The plan for reversing a locomotive engine where a single eccentric on a side was employed, never became very popular, on account of the complication arising from the angularity of the connecting rod, and the eccentric rod itself. Of course in this form the valve traveled full stroke all the time, as did also all the other forms of hook motion, but this was afterward remedied by the introduction of the "independent cut-off"—another valve riding on top of the main valve.

In Fig. 1 is shown one form of the single eccentric plan, the main rod is not shown, but the throw of the crank is shown as down and moving in the direction of the arrow, the eccentric rod was held up by a roller on the arm of a tumbling shaft that was let into a slot in the forward end of the rod, the rod terminated in two hooks, top and bottom, these hooks were spread wide apart at the ends, so as to catch the pin at any point of its travel and bring it to the bearing at the center of the V.

As it now stands, the lower hook is engaged with the pin in lower end of rocker; to reverse, the lever on the tumbling shaft was pulled back; this raised the roller *G*, and lifted the hook from the pin *D*, in lower end of rocker, and engaged the upper hook with the pin at the upper end, thus moving the valve for the reverse motion. Fig. 2 shows the plan used by a Mr. Cave, a prominent designer of that time; it differs very little from the plan in Fig. 1, except in detail; he used a much shorter eccentric rod, and advanced the eccentric to increase lead for forward gear, but the motion was distorted thereby. He used a loop on top V that admitted of a lighter form, and the doubled-hooked head was raised and lowered by a hanger, much as the present link is.

One peculiarity about this form of motion was that the engine was direct acting when running in one direction, and indirect when moving in the other.

On the first of June the Pennsylvania Railroad Company voluntarily advanced the wages of all its employes on the Southwestern Pennsylvania branch from 10 to 15 per cent. The increase equalizes the wages of the Pennsylvania road employes on all branches.

The B. & O., and the Central of N. J., are having cars built for a vestibuled express between this city and Washington, to be known as the "Royal Blue"; the cars will be painted blue—the engineer will be blew (up) if he don't make the time.

Report on Compound Locomotives, M. M's. Association.

The slight experience America has had with the compound locomotive, although elsewhere there are between six and seven hundred in successful service, so contracts the possible field to be covered by a report on the subject assigned to us, that we, of necessity, must go beyond the limits of this land and of this association for the major part of our facts; and in expressing opinions and conclusions, are compelled to take for granted a fair acquaintance with its modern literature, giving the experimental results of trials carried on outside the American continent.

To commence with—and as a help in the direction of narrowing the province to be covered by this report—we would suggest for discussion the following questions, viz.: 1st. Is increase of boiler pressure an essential element in the success of compounding? 2d. What gains have followed compounding? 3d. What are said to be its losses? 4th. What, per engine, is the increased first cost of compounding? and 5th. Does the saving more than balance this cost? 6th. What are American conditions for locomotive service, and can the compound locomotive meet them? 7th. Is it an essential defect of the compound that it must be short of starting power? 8th. Give a brief summary covering some details and peculiarities common to compounds.

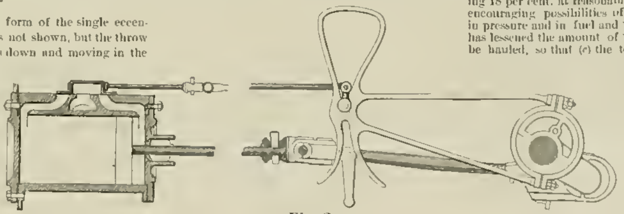


Fig. 2.

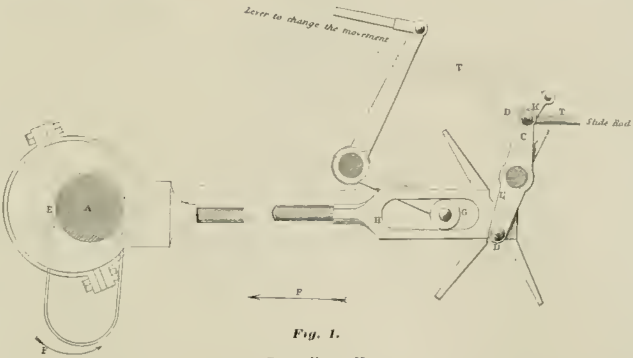


Fig. 1.

SOME EARLY VALVE MOTIONS.

1st. Is compounding of any value without increase of boiler pressure? This query is due to the repeated assertion that in compounding there was not, and could not be, an economy in steam consumption, except the boiler pressure be decidedly increased, raised to 170 lbs., or even higher. The results of the experiments of Mr T. Urquhart, locomotive superintendent G. & T. Railway (South-east Russia), contradict this statement. The trials cover a period of ten months, in the same class of service, with simple and compound engines practically of the same weight, and all with pressures of 135 lbs., and they show for the compounds a general average saving in fuel of 18 per cent.

Apart from this solution of the vexed question of pressure, Mr Urquhart's experience is unusually interesting, because the experiments were carried out in cold weather, with oil fuel, which has a more uniform heating quality than soft coal; and the delivery of the fuel into the fire-box was almost automatic, thus practically getting rid of the "personal factor," for which it is always necessary to allow in comparing special and brief experiments.

Mr. C. Sandiford, of the N. W. Railway, Lahore, India, reports a 13½ per cent. economy with unaltered, but still lower, pressures, viz., 120 lbs., the saving being the same whether the steam was used in two or four-cylinder (tandem) engines.

These results will not surprise those who are familiar with exactly parallel cases in other forms of steam engineering.

Do not misunderstand us to say that there are no economies in higher pressures. There are wide possibilities with high temperature; and the many published figures, from recent trials, stoutly confirm our opinion. But under this leading heading, the committee wished to emphasize the fact that compounding, at ordinary working pressures, has its own value as an economizer of steam, without keeping hid the sister fact that higher pressures give an additional possibility. And it should not be forgotten that very high pressure steam has, so far, only been fully utilized by passage through more than one cylinder.

Higher pressures and very early valve cut-offs, for simple engines, have had a fair trial on many of our railroads; nevertheless, to-day initial cylinder pressures above 150 lbs. are rare; and we believe that when boiler pressures higher than 160 lbs. are retained, it is with the object of making the boiler a reservoir of power for starting and grade climbing, rather than with a confirmed faith that very early cut-offs lower the fuel bill.

The Saxony Railroad report increasing their boiler pressures for simple engines from 8½ to 12 atmospheres (say from 120 to 175 lbs.), without resultant economy, whereas 212 lbs. has not proved too high for convenience or economy in the compound practice of the P., L. & M. Railway (France).

2. *What gains have followed compounding?* (*a*) It has achieved a saving in the fuel burnt averaging 18 per cent. at reasonable boiler pressures, with encouraging possibilities of further improvement in pressure and in fuel and water economy. (*b*) It has lessened the amount of water (dead weight) to be hauled, so that (*c*) the tender and its load are materially reduced in weight. (*d*) It has increased the possibilities of speed far beyond 60 miles per hour, without unduly straining the motion, frames, axles, or axle-boxes of the engine. (*e*) It has increased the haulage power at full speed, or, in other words, has increased the continuous H. P. developed, per given weight of engine and boiler. (*f*) In some classes has increased the starting power. (*g*) It has materially lessened the slide-valve friction per H. P. developed. (*h*) It has equalized or distributed the turning force on the crank pin, over a longer portion of its path, which, of course, tends to lengthen the repair life of the engine. (*i*) In the two cylinder type it has decreased the oil consumption, and has even done so in the Woolfe four cylinder engine. (*j*) Its smoother and steadier draught on the fire is favorable to the combustion of all kinds of soft coal; and the sparks thrown being smaller and less in number, it lessens the risk to property from destruction by fire. (*k*) These advantages and economies are gained without having to *improve* the man handling the engine, less being left to his discretion (or careless indifference) than in the simple engine. (*l*) Valve motion, of every locomotive type, can be used in its best working and most effective position. (*m*) A wider elasticity in locomotive design is permitted, as, if desired, side rods can be dispensed with, or articulated engines of 100 tons weight, with independent trucks, used for sharp curves on mountain service, as suggested by Mallet and Brunner. One such engine of 80 long tons is now under construction.

3. *What losses are said to have followed compounding?* (*a*) In some particular types, as actually proportioned, a loss in starting power of from 15 to 20 per cent. However, loss of power in starting cannot be said to be a defect in the principle of compounding. (*b*) An increase in the number of parts. They are few and plain in the two-cylinder engine, entailing little outlay in first cost or in repair. (*c*) A possible, but, this committee thinks, not probable increase in the cost of repairs to the boiler, per pound of fuel burnt, if higher pressures are used. Positive information on this point is difficult to obtain. (*d*) An increased cost of repairs to the engine per mile run. This item is not yet large enough to be measurable, after three years' continuous service in the plainer forms of the two cylinder compounds. (*e*) A larger percentage of failures on the road, due to greater

complication and size of parts. (*f*) Increased reciprocating weights on one side, either not balanced, and so increasing the deflection of the engine, or, if approximately balanced, the balance weight doing injury to the roadbed, etc. The two last sections seem to be pure suppositions, which, after search, we find no evidence to sustain. (*g*) Want of variability or adaptability to wide extremes in speed, and to amount of work to be performed; so that a large compound does not work as cheaply when hauling light loads, or running without load, as a simple engine does.

It is not proved that a compound, working properly throttled, that is, with steam wire-drawn, may not have actually, as she theoretically has, a wide and economical adaptability. So that if the compound, like any other motor, be not as economical when exerting low power as when exerting full power, it probably will use less steam than the simple engine of same weight, working under similar conditions of light haulage duty.

However, the one thing certain about "American conditions" is that no large portion of our motive power does run lightly loaded, and until we have a wider experimental experience, it is not recommended that all locomotives, doing branch and local light service, be built compound.

4th. What is the increased first cost per engine? M. V. Borries has published figures giving cost. In speaking of his own design of engine, he says they can "be built 2 to 5 per cent. cheaper than single engines of the same power—not of the same maximum tractive force, because this power depends upon the boiler, which might be 10 to 15 per cent. smaller for the compound engine. If the same boiler is kept, as is commonly the case, the compound engine would be some 2 or 3 per cent. heavier, and 4 or 5 per cent. more costly than a simple one; but, with properly dimensioned cylinders, 10 to 15 per cent. more powerful than the latter. For equal work the compound engine would always be the cheaper engine." Mr. E. Worthington says: "The intercepting valve and copper pipes forming the receiver, and the patterns for two different sizes of cylinders, are the chief items which raise the cost of a two-cylindered compound locomotive; while engines with three or more cylinders have additional parts, which considerably increase their cost. In engines with four cylinders, the tandem system is cheaper than the receiver system. Tandem cylinders are, however, objectionable, because the pistons are difficult to examine; but the receiver system is ready of access, and affords an opportunity of heating the intermediate steam by circulating it among the waste gases of the smoke-box; and, by isolating the high-pressure and low pressure cylinders, an advantageous difference of temperature is maintained between them.'

"The cost of constructing a number of two-cylindered locomotives does not greatly exceed that of the same number of ordinary engines. The cost of three-cylinder locomotives may exceed that of simple engines by $1,000 to $1,250 each."

The cost of changing simple to two-cylinder engines need not exceed $250 to $300 each, if the expense of drawings, patterns, and templates be divided over a series of engines. The additional cost of building a two-cylinder engine, with receiver, etc., as used by the M. C. Railway, or the ingenious form of four-cylinder engines, as used by the B. & O. Railway, need be little, if anything, over $200 (excluding royalties), or say from 2 to 2½ per cent. increase on the cost of a simple engine.

5th. Does the saving more than balance the increased first cost? If, for convenience, the fuel saving be taken at 17 per cent., or ⅙, and the gross consumption at 900 tons per year, with coal at $1.50 per ton, the decrease in the annual fuel bill is but $225. Certainly not a wide margin to cover contingencies. If, however, at first only the more powerful engines are compounded, whose consumption averages 1,200 tons per year, and coal, as is common, costs on tender $3 per ton, the saving on fuel is $600, or two cents per mile on a mileage of 30,000 per annum. As this amount would cover not only reasonable interest on first cost, but also allow for about 33 per cent. increase in total expenditure for motive power, repairs and renewals, the saving is certainly enough to permit a possible, but, we think, not a probable, largely increased cost of engine repairs, and yet have a margin of saving on the final balance sheet to the credit of the compound.

6th. What are "American conditions" for locomotive service? Can the compound engine meet them? We have given this section a large amount of attention, because it has so often been said that the compound must, to be successful on this continent, be adapted to suit American conditions, and your committee naturally were desirous of fully understanding these conditions. They have not been specified by those making the assertion, and we must reluctantly confess to having failed to identify, much less define them, so that after a long, unsatisfactory chase, they appear to us to be somewhat mythical. If any member can, and will, specify them, he will confer a favor, at least upon the committee, if not upon the association.

If an American condition be large starting power, then the Malett two-cylinder and all four-cylinder engines easily have cylinder power in excess of their adhesive weight. If American conditions be ability to do satisfactory work on a second rate or third-rate roadbed, or simplicity of construction, or easy accessibility of parts, then these conditions are met by any two-cylinder engine, or by the B. & O. Railway four-cylinder engine.

Apparently neither climate nor men are factors in this equation, as compounds are a success in the hands of ordinary enginemen in partially civilized countries; and in hot climates, as well as in Russia, under conditions of low temperature and snow, as trying as those ordinarily met with inside of 51 degrees, the present northern limit of our railway belt.

7th. Is it an essential defect of compound locomotives that they must be short of starting power? Certainly not! The starting power of the Malett type is at least equal to that of a simple engine of the same weight, and its cylinder power can easily be made to exceed it, by allowing more than half boiler pressure in the large cylinder for the first few revolutions. In the V. Borries, Worsdell, Pitkin and other two-cylinder types and the Lepage three-cylinder engine, their starting power (as Prof. Woods has graphically illustrated), at 170 lbs., may be greater than that of a simple engine at 150 lbs., having cylinders of the same size as the high-pressure, *during the first half revolution*, but that after this the power (at low speed) of the compound diminishes to 80 or 85 per cent. of that of the simple engine. This conclusion is modified and improved by the knowledge that all two-cylinder engines originally designed as compounds have, or should have, their small cylinder larger than the cylinder of the simple engine of corresponding weight or duty.

It is possible, with the Lindner or equivalent form of starting valve—and a painstaking engineman—to get about 90 per cent. of the starting power of a corresponding simple engine. The Webb type of three-cylinder engine (except with the low-pressure crank dead on center) has cylinder power enough to slip both pairs of wheels, and no higher starting power is desirable. What may be called the opposite form of three-cylinder engine (the Sauvage type), with cylinders of approximately the same diameter, as used on the Northern Railway of France, has ample starting power, because the full boiler pressure is admitted direct to the two low-pressure cylinders. In fact, if desired, the locomotive can be continuously so worked, viz., as a simple engine. Tancem and other forms of four-cylinder engines are not wanting in starting power. The B. & O. Railway engine in starting, with a gear as simple as the water tap gear, puts the small piston practically into equilibrium, and thus admits high-pressure steam to the large cylinder.

A mean effective pressure of 90 lbs. in a simple 18x24 in. engine will start a train of 18 coaches on a level in a lively fashion, and a compound can easily give the equivalent of that total pressure without being over-cylindered.

Going back to the two-cylinder style of engine, with automatic intercepting valve and limited size of cylinder, it would seem as if all of them were capable of getting into motion the load they were designed to haul at full speed, so that their limitations are that they do not get away quite as smartly, quite as noisily, or with the same tearing effort on fire and fire-box as do certain simple engines that waste both fuel and steam in starting. The comparative difference in time or distance required by this class of compound to attain maximum speed has not yet been shown by experiment, but is probably less than is generally supposed.

Mr. Urquhart, desiring to settle the question of the tractive power of simple engines altered to compound, with one cylinder unchanged, and with boiler pressure unchanged, carried out tests, using both indicator and dynamometer, and he reports that at a speed of 10 miles per hour the compound passenger engine suffered the following diminution, viz.: In first notch, 42 per cent.; in second notch, 28 per cent; in third notch, 17 per cent.; in fourth notch, 7 per cent.; and in fifth notch, or full gear, 5 per cent. And a similar test of the freight compound showed, in the first notch, 27 per cent. loss; in the second notch, 17 per cent.; in the third notch, 10 per cent., and in the fourth notch, or full gear, 5 per cent. He goes on to say that, for all practical purposes in full gear a 5 per cent. difference, at this speed, may be neglected.

(*Concluded on page 134.*)

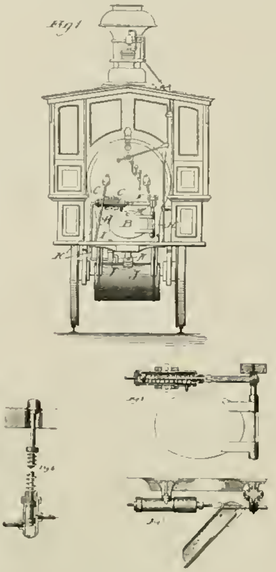
Fire Door Opener

On this page will be found drawings of a device recently designed and patented by David Hawksworth, of Plattsmouth, Neb., for opening and closing the fire door on locomotives, without requiring the fireman to use his hands.

Fig. 1 shows it as applied to a locomotive. Fig. 2 shows interior of cylinder, door closed. Fig. 3 is a plan, showing door partly open, and Fig. 4 is a detail of the operating valve.

Air or steam is used, but air is preferable, as it requires no exhaust piping.

Fig. 4 shows the push button, which is located in the deck, so as to be convenient to the fireman's foot; when the latter wishes to open the door, he pushes down the button as he brings his scoop into position; this moves the valve on lower end of stem that admits air to the cylinder over the door, and the air pressure swings the door by means of the rack and sector shown. When pressure is relieved, the spring on stem of button rod moves it up, exhausts the air from the cylinder, and the spring within it closes the door. The whole scheme is easily understood from the drawings.



FIRE DOOR OPENER.

Correspondence

The Old-time Engines of the P. R. R.

Editor The Locomotive Engineer:

In looking over the list of old P. R. R. engines in the June issue, I see the name Penrose; unless there were two engines of this name, am quite sure she was a Wm. Norris—will not be certain. The engine Heisley was a diminutive four-wheeler, she was the first engine to pass through the big tunnel west of Altoona.

The writer at that time was wiping engines at Altoona; one Saturday afternoon the R. R. Co. gave all hands a trip up to the tunnel; we had one coach, and the locomotive York, the crack engine of the P. R. R., and engineer John Stevens at the throttle. The F. K. Heisley had a party at the west end of the tunnel; the York was too large to pass through, as things were in an unfinished state, the Heisley, being very small, came through. The year I have forgotten, but the Logan House was being built at the time. Perhaps some old P. R. R. man can give dates. The engines Blair, Mifflin and Indiana were crank-axle engines, with six-foot drivers in rear of fire-box, a pair of smaller wheels forward of fire-box, and a four wheeled truck under front end. President Taylor went over the P. R. R. in a special pulled by one of these engines, at a speed of sixty miles an hour. The locomotive Harrisburg spoken of was an old Baldwin half-crank, with engine and tender on one frame. Wm. Nichols was Gen. M. M. at the time we made the trip up to the tunnel.

Corry, Pa. W. DE SANNO.

Cause of Locomotives Slipping in Going Down Grade Shut Off.

Editor The Locomotive Engineer:

I notice another article in your issue for June about locomotive driving wheels slipping while running down grade *after steam has been shut off*, which you supplement by saying, "What causes the engine to slip after steam is shut off is more than we can see. All the pushing of the train would exert itself at the axle, and in no way tend to slip the drives ahead."

My theory is this. The locomotive itself (not including the tender) is *very much heavier* than tender, or any one of the cars; the tendency of the locomotive on down grade (being so much heavier) is to run away from the train even after steam is shut off. The train, therefore (tender included), on a down grade, is not pushing the engine, but pulling back on it. I am speaking, of course, of locomotives without brakes on drivers and in support of my theory will say: First, that a locomotive with train of empty cars running down grade would slip more than with train of *loaded cars* running down same grade.

Second, that same locomotive running alone (or running "wild," as they say), down same grade would not slip drivers at all.

The "slipping," therefore, is caused by the backward pull of the train, or rather forward and heavier impetus of the locomotive, checked by the slower impetus of its following cars.

Your correspondent James A. Nute says he gave his engine sand and she stopped slipping; and he adds, "We had been running down hill about a mile from where I shut off." I understand from this that the engine had been running down grade about a mile before she slipped, then he "gave her sand, and she stopped." This would seem to confirm my position. As the impetus of the locomotive increased, the strain or pull on the locomotive increased until she "slipped."

J. H. BURRELL, JR.

Philadelphia, Pa.

[Our correspondent is wrong in presuming that a heavy load will run faster on a down grade than a light one. If they were of the same size a light load will run as fast as a heavy one; the heavy load will require more braking force to stop it in a given distance, however.

It is well known in practical railroading that on a long down grade a locomotive cannot run away from a train—if the train has time enough, and no brakes are applied, it will catch the locomotive every time. Suppose the engine did exert a pull on the train all the time, and the train held it back, there is nothing to cause the wheels to revolve ahead faster than the movement of the engine called for; they are held in close contact with the rail by the enormous weight piled upon them, and it would be impossible to make them slip on the rail by any propelling or retarding power applied to the axle. Besides this, the moving parts of the locomotive tend, by their friction, to retard the forward motion of the wheels. We do not pretend to say that this slipping does not occur, but, if it does, the cause will be found in the running gear or counterweights.]

A Subject for Discussion—"Herding" Cars.

Editor The Locomotive Engineer:

What is the matter with all shop and road men, that they do not let us hear from them once in a while? I just think your paper is the only chance I have ever found where all the boys can sail through without running on a snag. Now, boys, hoist your sails and let us hear from you on any subject. This paper seems to be open to all classes of railroad men.

I would like to hear some old and young railroad men's opinion on the train dispatcher. Is he a good investment to a railroad, or is he an expensive luxury?

The H. & T. C. transfer runs close to my office; they have a pretty good hill to climb and a very sharp curve. They have recently got one of Baldwin's large size sixty five ton engines, six-wheeler; she is very powerful; they have to wait at about 5 P. M. for S. P. trains. This engine is run by a Texas raised man; he remarked to me yesterday evening that he could put more cars up that hill than any four men could "herd"—that is what the Texas boys call switching cars here. Ask one of the yard men what he does on the road and he will tell you he is "herding" cars.

Houston, Texas. E. A. CAMPBELL,
S. M. P. & M., H. E. & W. T.

Some Difficulties in the Way of Campbell's Plan of Valve Setting.

Editor The Locomotive Engineer:

Mr. Campbell's pointers are hardly to the point; as his explanation of squaring valves would properly belong to the lathe and planer, and is not squaring as understood in railroad parlance. If we divide one revolution of the wheel into four equal points, and the engine exhausts at each one of these points sharp, she is called square; of course, we don't intend the four exhausts to be all on one side. We can hear engines every day that have a square exhaust nozzle and a three-cornered exhaust, and others with a round nozzle and square exhaust, and when some of the three-cornered ones get to slipping, it is hard to tell which is the off cylinder. Of course, the idea of the round holes is good, but your man is going to chip them out, what then? Your pointers on gauging a valve have a proviso; to wit, *if* the valve rod is the right length. Norris used to build engines with an inclined cylinder, but with the back end of the chest and seat the highest, so the square business would not work in gauging the valves in that case. Now, if this talk imparts no information to the reader, it does put a fellow to thinking. W. DE SANNO.

Corry, Pa.

A Good Job for the Engineer who can make a Locomotive Slip When Steam is Shut Off.

Editor The Locomotive Engineer:

One of the engineers on the Boston & Albany says that he has been coming down one of those steepest grades, and get to going so fast that the drivers would stop revolving and slide on the rail; he said it never happened on a dry rail. He would whistle for brakes and they would slack up, and then they would revolve again. This was before air-brakes were thought of. I asked him if the lead truck wheels slid too; he looked at me as much as to say: What a pity! and free schools in this country too!

I have been offered a new job since I wrote you before. One of the owners of a large shop here saw my sketch in last month's, and if he could get that engine that I run he says his fortune is made; he says he would disconnect the tender, put the engine on some of the heaviest steel rails, put bumper timbers at each end, have the flange turned off the back drivers, put jacks under each corner, grease the rail, fire her up, then I am to open the throttle, get her to slipping, then jack her up, then I shut off steam, dump the fire, and let her go Gallagher. They are to run the shop days, run the dynamo nights for the electric lights, have it so she can be oiled running; when they want to stop drop on the rails, give her sand. He says if she will slip for half a mile after being shut off, he don't see why she would not run till she broke down, if you have it fixed as above.

Worcester, Mass. JAMES A. NUTE.

How an Engine Can be Run with a Back-up Eccentric Rod Off.

Editor The Locomotive Engineer:

I am a constant reader of your valuable paper. I say valuable, because I have been running a locomotive a great many years, and have taken all the mechanical papers, and find this one far superior. All engineers should take it, as it is just what they need. It will help them in their daily labors, as it has helped me.

I see in the Questions and Answers, one asked by F. J. C., Oswego, New York, "Could an engine run with her back-up eccentric rod broken?"

I have on two occasions had the same happen me. It happened when I was hauling a mixed train; I had my full train, part passenger and part freight. After stopping I put her in back gear, and put a rope through the bolt-hole in link, then lashed it to the bottom of the pump where the feed pipe connects on; lashed it tight—it took but a few minutes—then proceeded to my journey's end, making my running time twenty miles an hour with my full train—and the engine worked well. A pump is not a necessity for this purpose; any part of the engine that is below the link. At the end of my journey I did some switching. This looks a little fishy, but it is the truth. When I wanted to back I would reverse, and send the fireman out and push the valve on the center, which could be done easily when in back gear; then she would perform the same as running with one side; pressure on valve would hold it central. There is one thing about doing this—they must be sure and have the engine in back gear at time of lashing; if not, it will not work. This, I am sure, will work to a charm, and in regard to backing she will do first-rate. L. S. SPRING.

St. Stephen, N. B.

Another Engine that Slips.

Editor The Locomotive Engineer.

In reply to your request, on page 100 of June number, I will send you the following as my experience with engines slipping when steam is shut off. It was with a 36-ton, Brooks engine of the ordinary eight wheeled type, 17-inch cylinders; do not know the weight on drivers; this engine would slip badly when running at high speed with steam shut off. Slipping could be stopped by hooking reverse lever up to center notch, also by using sand, but this was not advisable, as the slipping was so hard that the using of sand was apt to do damage to rods and pins. My way of accounting for it, was too much counterbalance in the front pair of drivers. The front pair had just the same amount of counterbalance when engine was built, but one wheel had been broken and replaced by another of a later pattern, which had a considerably heavier balance block, which gave a heavier counterbalance on one side than the other. After considerable study about the matter, I decided to call the attention of the master mechanic to the matter, expecting he would think I was getting some very foolish notions into my head, to report such a seemingly impossible thing as this. I did so, and told him what I thought was the cause of it. He agreed with me as to the engine's having too much counterbalance in front pair of wheels, but did not think it would cause the slipping. In order to test the matter, he reduced the balance weight on the heavy wheel down to about the same as the other wheels, and the trouble immediately ceased.

I think your paper a long way ahead of any one I have ever read, and of great value to engineers, firemen and shopmen, and well worth twice the price charged for it. WM. BOSLEY.

Mattoon, Ills.

[It seems strange that if this slip was caused by bad counterbalancing that the slipping could be stopped by hooking up the reverse lever. Most of those who report trouble of this kind claim, however, that proper adjustment of the counterbalances have cured the disease.]

Switch Targets.

Editor The Locomotive Engineer.

While this is a subject of vital interest to engineering and all classes of trainmen, they hardly ever discuss it or make any recommendations in regard to adopting a uniform system. On some lines three or four kinds of switch targets are used; lots of the switch levers for main line switches have no targets at all, sometimes one style is used for a main line switch at one end of a yard, and for an inside switch at the other end.

Some years ago we used to see the target set one way at a main line switch for "all right," at the very next station it would be the same way for the side track, so that an engineer or trainman was obliged to keep track of the difference in his mind, or get off the short rail. The more enlightened and systematic way of to-day don't permit that, and an attempt at uniformity is the result. It can be easily adjusted by selecting the best kind of switch stand and target in use on that particular road, and using them for main line switches, relegating the poorer kinds to inside switches and yards.

Then a more important point is, that a switch target should show a *positive* signal that the switch is set for the main line. The engineer should have a little notice that the switch is right or wrong before he gets close enough to see the rails. This he does not get when the target sets edgeways to him, when the main line is clear. The roads that show the edge of the target or no target at all when the main track is clear, say that a target is not of much use to a man on a fast train, but some of them have a clause in their rules which makes an engineer responsible for knowing that the switch is all right before he passes over it.

If the target on a switch moved by a crank, as most of them are at this day, shows one certain shape as well as color when switch is set for the main line, it is also in the line of safety to have a different shaped target on the side of the first one, which points out definitely which siding is connected with the main line. Colors are apt to lose their brilliancy, so they will not always prove a sure guide, when the target is covered with sleet and snow the *shape* of it is the only satisfactory guide.

Some of the roads in this State have a standard switch target, which shows positively the position of the main line switches, whether open or shut, and they can be easily distinguished from the inside switches. Several roads use a large white disk from 11 to 24 in diameter, the side is visible when main line is safe, if kept painted it shows a long way off either day or night. On one side of this is a siding signal, which is 10" to 18" long with a fish tail end, which is seen when switch is set for the siding, painted the danger color, bright red. This siding signal points the same way as the switch crank for a stub switch, and the opposite way for a split, so an engineer knows into which siding he is going. When the edges of all main line switch targets are set towards the engineer when switches are shut, he takes everything for all right, and in a manner, goes it blind.

However, the split switch is gradually crowding the dangerous "stub" off the main line, before long a fast passenger train will not be run over stub switches at a high rate of speed. If entrance switches at stations have targets and lights a little higher than the rest of them, they are better land marks. The ideal switch target is one which moves to danger before the switch is opened, and stays there till it is closed. It has not been made yet, but would be certain and cheap, but it will get here—some day. C. B. CONGER

Lansing, Mich.

Keeping an Engine Clean.

Editor The Locomotive Engineer:

A locomotive fireman always has lots of scouring brass, blacking boiler butt and smoke arch, cleaning domes, jacket, windows, cab and other work, and the easiest way would be the best, providing it was the best looking when done. Now I, for one, would like to hear from brother firemen through THE LOCOMOTIVE ENGINEER on this subject. I will give my experience, and hope to hear from others. The ways are old to many, still I think some will find it new. For cold brass I use oxalic acid (quite strong) and tripoli on a piece of waste, then wash it off with water (this prevents making the brass hard), then rub with lantern oil and tripoli or Putz pomade, wipe that off and polish with lamp black, in this way you get a good polish easily. For hot brass I put a little lantern oil with the acid, which prevents sticking of tripoli to brass. I have used tripoli, lard oil, and Putz pomade all over engine, also tripoline and matchless polish. I am going to try the recipe in May LOCOMOTIVE ENGINEER.

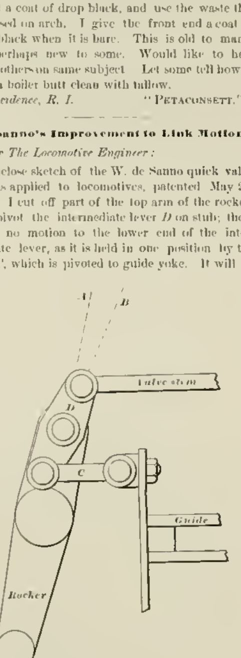
For polishing dope on smoke arch, I use one quart boiled oil, one gill drop black, half pint varnish, half pint Japan, three gills raw oil, all well mixed. To use: Take piece of waste, wet it with water, rub it full of soap, squeeze it hard, and then fill it full of the dope and rub on arch with one hand, and, with a piece of clean waste in the other, wipe over it, this will make it black and glossy, and will not gum up but very little; you can keep your arch right down smooth, with very little oil over the iron; and when it rains you do not have the arch all peeled up in places, but the rain washes it *all* off. Then take a piece of sand or emery paper and rub it down, and put on the dope; use the piece of waste that you wipe off arch with on boiler head, and wipe that over with clean waste afterwards. I use the dope to black the domes same way as on arch; I use tallow on stack and on outside of cab, wash cab inside with soap and water, and wipe dry; on windows I use whiskey (hydraulic jack) and tripoli. This dries quickly and wipes off clean. On the jacket I potash first, then wash off with a hose, then tallow, then wipe off tallow dry. When it storms I tallow jacket, and when it is over wipe it off with waste and lampblack. When a boiler head is gummed up badly I take a hose and give it lots of cold water, then it peels all off clean. Emery cloth it, then give it a coat of drop black, and use the waste that you used on arch. I give the front end a coat of drop black when it is bare. This is old to many, but perhaps new to some. Would like to hear from others on same subject. Let some tell how to keep a boiler butt clean with tallow.

Providence, R. I. "PETACONSETT."

De Sanno's Improvement to Link Motion

Editor The Locomotive Engineer:

I enclose sketch of the W. de Sanno quick valve gear as applied to locomotives, patented May 27, 1890. I cut off part of the top arm of the rocker, and pivot the intermediate lever *D* on stub; there being no motion to the lower end of the intermediate lever, as it is held in one position by the link *C*, which is pivoted to guide yoke. It will be



DE SANNO'S VALVE GEAR.

seen that the intermediate lever gives a quick motion to the valve, as it also increases the travel.

In applying this device to an old locomotive, the extreme notches in the quadrant must be blocked up, and the links worked at what would be equivalent to full stroke or travel of the valve by the old method, and the valves re-set to suit the new order of things; it is also likely that the inside lap would have to be increased with this motion, that being left, however, to the judgment of the parties using it. W. DE SANNO.

Corry, Pa.

Lubricators that Feed Across.

Editor The Locomotive Engineer:

In looking over this months' paper, in Questions and Answers I notice O. C., Boston, Mass., 38, wants to know if it is *possible* for double feed lubricators to feed across, to one cylinder or the other, I would say that I have had a little experience of that kind on an engine on the road where I am employed; it is a Seibert oiler, double glass, upfeed; it worked to all outside appearances as nice as one could wish, but the left-hand cylinder groaned continually. I asked the foreman if it was possible for both feeds to go the right hand side; he smiled, and asked me if I did not know that it was impossible, as there was a separator in the T at back of oiler. I told him I knew there was a bridge of brass in a good many places that was not effective. The result was that oiler was taken apart, and what we found was the oil hole in feed pipe to left hand side at the union was plugged solid, the engine had been running that way two months; all the oil that side got was put in through release valve on front of steam chest; after that we had no trouble.

Plainfield, Ct. NEW ENGLAND

Some New York Central Engines that Slip Even with the Main Rods Down.

Editor The Locomotive Engineer:

I am glad the "slipping driver mystery" has been brought to your notice, and hope we shall hear more about it.

Mr. James A. Nutes' article leads me to infer that his engine was slipping when he shut off steam, and continued to slip (until he gave her sand), which is a very common thing on a slippery rail. Now the problem I would like to have solved is this: What causes an engine to slip when no steam has been used to start her slipping, while running along, say twenty-five miles an hour? This subject of "driver slipping" is not new on the New York Central, for I have heard engineers tell about it, ten years ago, and they are men whose integrity cannot be questioned.

John Hutchinson says when he was running old 85 on the Albany division, she would slip her drivers after she had run along a mile or two without using steam, so that he thought she would strip herself. This matter has met with much ridicule on this road, but I believe if men would study the subject before they express an opinion, it would not appear so ridiculous to them. I have heard engineers say, less than five years ago, that it would be impossible to discard the pump and run with inspectors; and to-day those same engineers say they would not give one injector for all the pumps they ever used—they may change their mind about engines slipping too.

Now, Mr. Editor, here is something to "bite" on, and I presume, when some men see it, they will say the man that told the "yarn" is "off," and the man that wrote it is "offer," but I don't care, I believe the man that gave me the following facts, and his name is Joe Norman. Engine 121 is a Schenectady engine with 62" wheels and 17"×24" cylinders; she has solid side rods weighing 250 lbs. each, her drivers have each four pieces of counter balance cast into them about half the length of spoke; weight on drivers about 25 tons. This engine was built for freight, but was equipped with air-brake and put in passenger service, and runs between Syracuse and Niagara Falls via Auburn branch. Charley Thomas and Ed. Shaffer double crew on her, and both are familiar with her slipping. A short time ago Shaffer went to California and Norman took his place, and here is what Norman says. Shortly after he took the engine, and while coming down one day, he heard an unusual noise, and asked his fireman what he thought it was. The fireman said, "Oh, that's nothing, she is only slipping." Joe looked at him with astonishment and said, "Slipping *be darned*; you must think I'm a farmer," and in order to convince him, the fireman stepped over and gave her sand, and stopped her slipping; Joe was convinced. The next trip Joe made on her she blew out a rivet, so he had to dump her and be towed in, and after getting under pretty good headway, *and while being towed, she began to slip worse than ever.*

Mr. Norman and fireman are both willing to make affidavit that the above facts are true. Now for the purpose of getting up a little discussion, I will give an opinion as to the cause of this engine 121 slipping with "main rods off." In the first place, she is a very slippery engine, and I believe that the momentum of the drivers, after the engine had attained a certain rate of speed, was sufficient to cause them to slip, especially if she struck a slippery part of the track, and, too, with main rods off, there was much less resistance to the wheels, which allowed them to slip with greater ease than if the main rods were left on; then again it might be a twisted shaft that caused the slipping. Let's hear from some one else on this subject.

Syracuse, N. Y. W. F. RELYEA.

Squaring Valves and Rocker Arms.

Editor The Locomotive Engineer:

When I see or read of one of those elastic men, that can always do a thing in about one third the time that it would take a man who is simply flesh and blood, without elasticity, I find it hard to refrain from attacking some of their wonderful *sayings*—for observation has convinced me that they are not *doings*.

Your contributor, Mr. E. A. Campbell, makes the statement in the April number, that he would not allow a man to set valves for him that could not do it in ten minutes, and further adds that lost motion has nothing to do with the engine working well.

Such broad statements, without some qualification, could not come from one who regards the truth essential to progress.

I waited patiently for Mr. Campbell's 10-minute method of valve setting, or "squaring"—as he seems pleased to put it in the June number—and found it similar to a "seven-hour system in grammar" that was published several years ago—too much India rubber in the statement.

You will notice he only does a part of the work necessary to the squaring of the valve, and leaves the rest for some poor machinist to do. Also, that he concluded to square the valve by the eccentric blade, and not by the shoe (or dead wedge as sometimes called), as he suggested in the April number, and quoted in the June number.

Now he does not state how long he will be in testing the work of the machinist; perhaps he intended to leave that for the machinist, so as to help him out on the 10-minute business, or he may regard it unnecessary to try the valve again, presuming that he can guess exactly how much to move the eccentric blade and make her square.

Any man familiar with the link motion will tell you that when the length of blade is to be changed it is not safe to change it, and not prove your work, unless the work be new, and one is familiar with just that particular design of engine.

Mr. C. is inconsistent when he finds fault with the slotted holes in blades, and says they are made without them to keep meddlesome engineers from altering, and in another breath tells them to square the valve with a liner back of the shoe. Such managing tends to make meddlesome engineers.

Now in my opinion a good engineer—one who knows enough about valve motion to let it alone, unless he has the necessary tools and ample time—would never attempt to monkey with his engine, but would endeavor to locate the defects, and report same to proper persons. And if Mr. C would like to keep his hair from turning white, and not be troubled with indigestion, he would have no other engineers in his employ.

Again. He gives us a rule for "gauging" a valve without taking the steam chest cover off, which cannot be relied on in all cases; certainly is not correct for engines having inclined cylinders whose valve seat is not parallel with the center line of cylinder. Such engines are in use to-day, and Mr. C. could not square his rocker arm in 10 minutes by that method on such an engine. It is to his credit that he winds up by advising us to take off steam chest cover to examine the work done in that manner.

If Mr. C. would either make or buy a good valve motion model, and then put in a few hours of rightdown honest study of the link motion, he would not be so liable to blunder into trouble that he does not "have time" to clear up, as he states in the June number of THE LOCOMOTIVE ENGINEER. A line drawn through the center of rocker box and upper rocker arm pin should be at a right angle to *valve seat* when valve is in its central position, or center of valve seat, and a simple method of obtaining this is to lay a straight edge on valve seat, that is long enough to reach the rocker arm, then by using a square in connection with straight-edge, the rocker arm can be set at a right angle to valve seat. Now make a small prick-punch mark on and near top of rocker arm, and use tram from this point to another point on frame, and you have an accurate method of squaring rocker arm without removing steam chest cover but once.

Troy, N. Y. CYRUS F. RICHMOND.

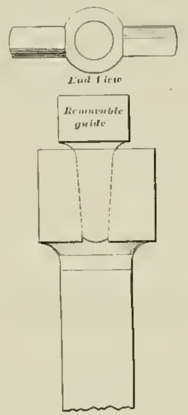
Some Kinks in Shop Tools.

Editor The Locomotive Engineer:

There has lately been going the rounds in various forms, new and improved "guides" for counter boring. Some have straight shank and set screws, and some screw in the counterbore, but the best that has ever come under my notice is one used at the P. W. & B. shops at Wilmington, during Mr. Gordon's reign, and probably in use yet. It is often called for in repairs, and the work of changing guides or "tits" is almost nothing. The sketch will show the whole thing in a nutshell. The counterbores, whether they be flat or round, are reamed to a standard taper to receive the guides, and they fit, and fit central every time, not being pushed out of place with a set-screw at the side, as some are. A pin hole through them makes an easy way for removing, or they can be forced out by a pin in hole just behind the shank, as many Fox lathe centers are.

The sketch shows one in place, also an end view of a flat counterbore. By having a number of guides and counterbores any repair shop can call itself well equipped in that line.

Another tool that I have been using lately will perhaps be of interest, as it is a rapid and easy cutting tool. I recently took a cut on a 20-inch lathe, driven by a 2-inch belt, which was ⅜ of an inch deep, and when a 2-inch belt will pull a ⅜ cut it shows that the tool must cut very easily and makes a shearing cut. Baldwins use this form of tool almost entirely and find it superior for ordinary



COUNTERBORE.

LATHE TOOL.

work to the old-time "diamond point" which has held its own for so many years.

The sketches will show the idea, and each can easily learn to grind it so as to cut the easiest. For repair work or any work where time is an object, this tool will be found particularly useful.

Philadelphia, Pa. FRED H. COLVIN.

What Causes This Heating?

Editor The Locomotive Engineer.

I am running a Hinkley mogul with a common valve, no patent attachments at all, but has relief valves in front of steam chest, this engine came to me from the main line. She is on what is considered a fast express freight. The road is hilly and very crooked, and I have to run with closed throttle in some places. The first night I ran that engine I noticed she was blowing through valve seat and cylinder packing on left-hand side, also considerable groaning there. When I had got about twenty miles out I noticed an unusual noise in cylinder when running by gravity. I opened the throttle again, all was as usual, Seibert oiler was working all right and I got over the trip without further trouble. That day I bored holes in the exhaust pipes under saddle, to let off the water that accumulates in such places. That night I had a repetition of the night before, only worse, the lever commenced to yank, the valve to chatter, the cylinder sounded as if everything was smashed inside of it, and under the engine the fire flew lively. I called for brakes and stopped. I honestly thought I had picked up something from the track when I saw the fire fly. I looked that engine over, tried all journals to see if everything was cool, but could not find anything wrong about her, so I called off brakes and started. When I shut off again the same noise and fire flying took place. After I had run about two miles I opened throttle and it stopped, then I knew where it came from, or I believe I do; the junk ring was riding on the bottom of the cylinder, the follower head was the colors of the rainbow, the cylinder was scored all around, the valve seat was cut, and very rough. I summed it up this way—first the engine has got a Seibert oiler, double feed, a common valve and relief valves in steam chest, oil allowance one pint to seventy-five miles. When working steam, with what oil she got, the steam served to lubricate her enough to keep things quiet, when shut off, release valve drops, the oil comes down through oil pipe in vapor, strikes the top of the valve, the steam is condensed by coming in contact with cold air from the release valve, drops in recess of the valve and stays there, none goes to cylinder at all, for cylinder shows red rust all around. I claim the cylinder got over-heated by junk ring riding on lower part of cylinder, forming a gas which exploded and showed fire underneath through the holes I made in exhaust pipes. I talked with the older men, and, as usual, they said it could not be. Now I am of the same opinion as at first, regardless of older runners. What is your opinion?

Plainfield, Ct. NEW ENGLAND.

[It looks very much as if the trouble came from the absence of oil. Red rust in the cylinder and cut surfaces would seem to substantiate that theory. If the trouble is on one side and not on the other it would seem to indicate that the oil was not delivered on that side. Disconnect the oil pipe at the chest and see if it feeds. Your piston packing may be follower bound and help in the cutting process, but it is intended that the bull ring, or junk ring, should ride on the bottom of the cylinder and carry the weight of the piston—more oil, better oil, or at least *some* oil will doubtless help you.]

Equalizing Pressure on the Double Air Gauge.

Editor The Locomotive Engineer:

I can answer question in regard to increase of pressure on train pipe gauge when using emergency stop. If the valve is moved suddenly to full emergency stop position it will cause a sudden jump of train gauge pointer, but the increase of pressure will be slight; now move the handle of valve slowly until the exhaust through the emergency port blows strong, you will notice pressure on train pipe gauge will equalize with main drum pressure; this is caused by the small feed port in rotary valve coming in communication with equalizing port, allowing air from the main drum to flow into service stop drum equalizing the pressure. To prove this, take out rotary valve, plug up small feed port, replace valve, put handle in full release position, pump up pressure and use emergency stop; the gauge will then show no increase of pressure.

ENGINEER ROCKY MOUNTAIN DIVISION,

Missoula, Mont. NORTHERN PACIFIC.

Standard Size for Axle for Heavy Tenders.

The master mechanics have adopted the standard M. C. B. axle for 60,000 pound cars for heavy tenders, thus avoiding the carrying of two sizes in stock that must of necessity be almost identical. This axle tapers, without curve, from just back of the wheel fit to the center.

The committee report in favor of 300 pounds per square inch of contact as a safe load for the journal. The size of this standard axle bearing is 4¼x8 inches, which gives 225 pounds per square inch for a heavy tender of size specified in their circular, which they describe as one well able to carry 3,600 gallons of water and 16,000 pounds of coal.

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS.

The Pay of Master Mechanics.

As a rule, master mechanics keep their jobs longer than superintendents, trainmasters and other transportation department officers, but they do not begin to get the pay that the latter do.

There are a few roads that pay a reasonable salary to a superintendent of motive power, but we believe it safe to say that the average pay of master mechanics throughout the country is not above $1,800 per year, while a majority of division master mechanics receive a third less.

If these men held jobs that required little work, or no particular knowledge of mechanics, there would be some excuse for the stingy pay; but the position requires a good man, a hard working man, one who is able to handle men, to accomplish much with cramped financial resources, who can get along with little material, and run his shop short-handed and equipped with ancient tools.

The master mechanics of the country are made of the better class of engineers, machinists or draftsmen, and ought, at the very least, to receive as high salaries as the best men under them—there are very few master mechanics who get as high pay, month in month out, as their own engineers. This not only lowers the officer in charge to a level with his men, but takes away some of his self-respect, and does not raise his dignity with those under him.

The management of our roads have squeezed at our motive power departments so long that the injustice and unreasonableness of expecting so much for so little has become second nature to them.

Of course an engineer making $140 per month cannot afford to give up his run to worry over a master mechanic's job for $90 or $100, so a less capable man takes the place, and the standard is lowered just the difference between them, and the service suffers.

As a class, there are no employes of our railroads that earn and deserve better pay than the master mechanics, and the picayunish little checks they get ought to be a shame to the management.

A manager or superintendent who received the same pay as conductors or brakemen would not be counted as much good—and he ought not to be much good. What is true of one department is true of another.

There is not a road on the American continent that can afford to have a wooden-sheared lathe or a seventy-five-dollar master mechanic in its shops; both show bad management and dangerous equipment of the vital part of the passenger carrying department.

A Death Trap and Its Victims.

On May 30th a local train connecting the city of Oakland, Cal., with the ferry-boats for San Francisco, plunged into an open draw bridge at Webster St., Oakland.

The engine, tender and one car went into the draw where the water was deep, and thirteen out of the forty odd passengers were killed.

This bridge is 100 feet long, over a stream 20 feet deep, and the trains approach it at a high rate of speed from a curve. When the bridge is open, the bridgeman is supposed to signal the trains by sticking a red flag in the end of a tie.

If the railroad wanted dead passengers instead of live ones, and deliberately planned a trap to catch them, they might go a great way and hunt a long time before finding a better device for execution than this bridge.

It seems that the usual primitive plan of stopping at each drawbridge was not even followed, they put out a red flag—if the watchman thinks about it—and the trains run fast over a bridge, carrying a passenger train every thirty minutes, and being constantly opened for the passage of vessels.

The least that could have been done was to stop for the bridge, and, if this was a rule and the engineer did not stop, he is guilty of a crime and should be punished; but, even though this rule was in force, it does not clear the skirts of the company—they had not provided this dangerous spot with proper signals—distance signals that must be set at danger before the bridge can be opened, and a derailing switch to throw the engine off the track if the engineer ignored the signal. These are modern safeguards; they are not expensive nor untried, and any road that crosses drawbridges without them should be held responsible for every life lost.

The coroner's jury, as usual, blame the engineer, and mildly remonstrate against the primitive signal system that caused this accident.

They find that the deaths were caused by the criminal negligence of engineer Dunn, and add:

"We find engineer Dunn guilty of manslaughter. We also find that the railway company does not take sufficient caution to signal trains when approaching the drawbridge."

Are you living up to all the rules about dead stops at draws and road crossings?

Some Continuous Brake Statistics.

The English Board of Trade, to whom all railroad accidents in Great Britain are reported, and who officially investigate all fatal accidents, have recently published a statement of the reported brake failures for July to December, 1889. This report shows that trains equipped with Westinghouse automatic ran 23,325,198 miles, and had charged against it 359 faults. The automatic vacuum was used on trains that ran 40,272,589 miles, and had 331 faults charged against it. Clark & Webb's automatic ran 911,048 miles and failed 3 times; the same company's non-automatic brake made 918,564 miles with two faults. The plain vacuum was on trains running 12,036,390 miles with 52 failures, and the Westinghouse straight air-brake ran 773,885 miles without a fault. This is 64,973 miles to one failure for the automatic air, 121,670 miles for the automatic vacuum, 231,469 for the simple vacuum, and 773,885, without a fault, for straight air.

These figures show that there were 76,407,162 miles run by braked trains in Great Britain in six months—rather large figures.

Every time a brake fails to stop a train at the right time and spot is called a fault, which is an erroneous deduction—the man often fails. Human beings are not always sure, neither has there yet been built a device for any purpose not liable to fail.

Two Kinds of Management.

A recent meeting of railroad men was held in Philadelphia, at which a grievance was introduced by representatives of the Baltimore & Ohio road, showing that the train employes of the Pennsylvania Company received larger pay for the same service performed by them. The committee stated that on through runs between Philadelphia and Washington on the Baltimore & Ohio, conductors in their fourth year received $4.12 per round trip; baggagemen, $2.25, and brakemen, $1, while on the Philadelphia, Wilmington & Baltimore, conductors receive $6, baggagemen, $2.75, and brakemen, $3. On the division between Philadelphia and Baltimore, the Baltimore & Ohio conductors receive $2.90 per round trip, baggagemen, $1 61, and brakemen, $1 29, while on the Pennsylvania, conductors receive $4.24, baggagemen, $2.60, and brakemen $2 36.

The Secret of Fast Time.

The White Star steamship "Doric" has just returned from a trip around the world; she steamed continuously without slowing or stopping for 77 days, 6 hours and 50 minutes; making 28,000 miles. This is considered fast work, yet the speed is but little over 13 miles per hour, slow speed, even for a freight train. One of our modern passenger engines making 60 miles per hour ought to get over the distance in a little less than 20 days. It is rather doubtful, however, that if there was a continuous system of railroads around the earth, the average traveler would get around the globe in less than 77 days. There are so many stops and slow-downs in railroad trains as now run. The secret of making time is to keep going—get away from stations, and move.

The first steamboat on the Mississippi River was the New Orleans, built at Pittsburgh, in 1811, by Nicholas J. Roosevelt, from plans furnished by Robert Fulton.

Car Platform Gates.

There is one little improvement on passenger cars that is coming, and is deservedly popular where used, and that is the platform gate. By using a light iron gate on each side of the platforms there is no danger of people being blown or thrown off while passing from one car to another; by keeping the gates closed on one side, passengers are prevented from getting on or off trains on the wrong side, the habit of getting off on the wrong side, to avoid the crowd, has cost many a man his life; this danger is double on roads having more than one track. On double-track roads the company that does not use gates on passenger car platforms, is not furnishing its patrons with the best modern safety appliances.

On the Ladder.

J. McNaughten, Master Mechanic at Livingstone, Mont. T., for the N. P. Co., has been appointed Supt. of Motive Power of the Wis. Central, in place of John Player, resigned. Mr. McNaughten is a rising young mechanic, yet in the early 30s.

Angus Brown, M. M. of the Yellowstone division of the N. P., goes to the Montana division in place of J. McNaughten, and General Foreman Gardner, of the Missoula (Mont.) shops, has been promoted to be Master Mechanic at Glendive.

ASKED & ANSWERED.

(43) E. H., Manchester, O., asks:

What do you mean by a "floating box" truck? *A.*—A truck in which the journal boxes are free to move up and down in jaws or pedestals.

(44) J. D. B., Greenville, Texas, asks:

What operated the Creamer brake—steam, air or vacuum? *A.*—The Creamer brake was operated by a coil spring which wound up the hand-brake staff.

(45) Crow, St. Paul, Minn., asks:

What is the standard length of the new hook coupler? *A.*—The Master Car Builders' Standard Janney Coupler is 30 inches long for new cars, and 28 inches for those placed on old cars.

(46) Fireboy, Middletown, N. Y., asks:

What effect on the fire would a good blower have if the smoke arch door was open? *A.* No perceptible effect; the blast would induce a current of air up the stack, but the air would be supplied from the nearest and easiest source, which would be the open door of the arch.

The U. S. Circuit Court of Georgia has granted a perpetual injunction restraining the officers of that State from collecting taxes on sleeping car companies doing business in the State. The comptroller general had a bill against the Pullman Co. for $32,000. This will give a black eye to several State taxation boards, who have been figuring to fleece Pullman. The Pullman Co. will pay their taxes in Illinois and Michigan, where their works are located.

The New York, Lake Erie & Western Railroad Company has let a contract to Neafie & Levy, of Philadelphia, for a new ferry-boat to run between New York and Jersey City. The boat will be 230 feet long, 38 feet beam, 62 feet wide over the guards and 16 feet depth of hold. It will be a double-screw boat, with a propeller at each end, much on the plan of the Bergen, of the Hoboken ferry. The engines will be of the compound type.

The Order of Railway Conductors repealed their anti-strike laws at the recent Rochester convention, on account of the pressure of the new order of the Brotherhood of Railroad Conductors, and the other orders. Now several of their lodges have thrown up their charters, and the Reading have ordered their employes to quit the order—they are out of luck.

The business of the Santa Fe road has increased $2,489,326 in nine months, from July, '89, to March, '90.

The Master Mechanics' Meeting.

The twenty-third annual convention of the American Railway Master Mechanics' Association was held at Old Point Comfort, Va., June 17th, 18th and 19th. This association has a membership of 363, including most of the best known master mechanics in America. At Fortress Monroe, or Old Point Comfort, there is a fort and a hotel, so the usual welcoming speech by the mayor was not possible, and the welcome address was very neatly delivered by M. E. Ingalls, president of the Chesapeake & Ohio road, who reviewed a great deal of the interesting history of the immediate surroundings.

Within sight of the meeting-room the great fight between the Monitor and the Merrimac took place on March 8th, 1862; in front is the battery on the Rip-Rap, behind, the walls of Fortress Monroe. President Briggs made a hit in his speech; it was received with great satisfaction, and was the subject of much comment and congratulation. We have space but for two paragraphs, the first showing something of the work of this association, the second a just tribute to the rank and file under the command of the members of this society, and showing from whence the whole army has been recruited.

"The great diversity of territory through which our locomotives travel would seem to prevent anything like national uniformity in construction, severe grades demanding features in the engine not required over prairie country, and other special forms provided for use in special localities; but when we travel through our country and see the different locomotives at work we cannot but be struck with the great similarity of these powerful machines, and we feel a glow of pleasure in the knowledge that the existing uniformity and excellence has been attained more through the labors of this association than from any other influence. This thought inspires us with confidence in our progression, and we look forward to our annual convention in the full security of individual improvement as members, and enlarged and enlightened service for the companies we represent.

"As we contemplate the immense work that our locomotives have been made to perform in the transportation of the harvests from the prairie to the seaboard, in the movement of all living and dead freight, creating cities, establishing markets, breathing life and civilization, making the 'desert even blossom as a rose,' let us not forget the grand army of faithful engineers and firemen to whose care these vast machines are entrusted; an army of men larger in numbers, stronger in discipline, richer in intelligence and higher in bravery, than any Alexander could ever boast. These men, largely recruited from humble life, form a perpetual monument to the mothers who gave them birth, true type of our American womanhood, who sent her boys to school and struggled so often with poverty and privation that her children should have every opportunity for gaining knowledge, and who, by a lifetime of devotion, has encouraged and fortified us all in the development of our progression."

The secretary's report showed a membership of 363, of which 15 are associates, and 14 honorary members. During the year 18 were dropped for non-payment of dues, 3 resigned and 3 died; one of these, H. M. Britton, was one of the organizers of the association, and for several years its president. The circulation of the annual report was shown to be 1,317 copies.

The treasurer's report showed a total receipt of $3,174.52 during the year, and a balance on hand of $1,080.67.

A change in the constitution was made, providing for the use of written ballots without nominations.

The association has about $7,000, known as the "Boston Fund," and Mr. Setchel, the custodian of the fund, introduced the following resolution, which was unanimously carried:

"*Resolved*, By the American Railway Master Mechanics' Association in convention assembled, that a committee of three members, consisting of J. N. Lauder, John N. Barr and Angus Sinclair, be, and are hereby appointed, empowered and directed to confer with the trustees or other proper officers of the Massachusetts School of Technology of Boston, and Cornell University of Ithaca, N. Y., and the Stevens Institute of Technology, and arrange and report a plan at our next annual meeting for the investment of the principal and interest of the Boston Fund of this association in one or more scholarships in one or both of these institutions, and submit the same for the approval of the association. The benefits of said scholarships to be for such time as may be directed by the association as a prize to the sons of members who shall exhibit the most valuable attainments and skill in the development of locomotive mechanics.

"And be it further *Resolved*, That notice is hereby given that a vote will be taken at our 24th annual meeting to so appropriate said fund."

The first paper read was the one on compound locomotives, which was of considerable length and of great interest. The committee made research far and wide, and presented reports from all the compound locomotives in America, as well as the results of experiments made in England, France, Russia, Saxony and India. The report was considered the best one read, and is published in full in another column, to which the reader's attention is directed.

One paragraph of their report may be of especial interest to those of our readers who took part in the discussion on the "full throttle" subject. We quote:

"Putting emphasis on this truth will not frighten those who are familiar with the fact that wire-drawing is common to-day with our best enginemen. And it may be here noted that the *imperative necessity* for this so-called "crude practice" is the full explanation for the slight use in modern locomotives of screw and other finely divided reversing gears. This statement opens up the whole matter of cylinder condensation, but it is too large a matter to be properly treated in this report.

"However, such modern experimenters as Westinghouse, Kennedy, etc., prove that wire-drawing the admission into cylinders of large surface and small volume is more economical than valve cut-offs at less than 50 per cent. of the stroke."

The next report was on the efficiency of the link as compared with other valve motions; this paper was long and interesting, and contained valuable data on the various forms of valve motion, and while some show a slight saving in fuel all were expensive in repairs.

The committee express regret that they had no report of the utility of the Strong valve gear but publish the following from Ross Kells, of the Erie:

"We have only made one test of locomotive equipped with a valve motion other than the link, and that test was to determine which of the two designs was the most economical on the basis of coal consumed per ton per 100 miles. We found on this test that our regular link motion locomotives were fully as economical on coal, and much more economical on maintenance of valve gear."

Almost every one knows that it was under Mr. Kells on the Erie that the Strong was tested and the elaborate report compiled by her owners showing her superiority over ordinary locomotives.

The report concludes as follows:

"Nowhere is the 'survival of the fittest' more pronounced than in railroad practice. The history of valve motions and devices to improve the link motion, and those that were to supersede it (?) would fill volumes. Many have been theoretically correct, and very promising, but, after the crucial test, have resulted in failure; and the link motion remains in almost undisputed possession of the field.

"It has been urged against the link that it is not a scientific or true mechanical motion. This may be true, but the fact remains, that fairly good results are obtained from it; that it will take more punishment in the shape of rough usage and neglect, and cost less to make and repair, than any other valve motion now being experimented with on locomotive engines.

"In conclusion, your committee are of the opinion that there has not been brought to their notice a valve motion more efficient for all-around work, and general utility, than a well designed link with large bearing surfaces—assisted in its work by steam passages and pipes of generous dimensions—free from sharp turns and bends—giving the link plenty and hot steam to distribute, and, most important of all, not crippled at the very end by a contracted exhaust nozzle."

The committee on the subject of placing fire-boxes above the frames presented a report in which they say:

"In summing up, the evidences prove that with the fire-box above the frames the combustion is very much better than when between the frames; and larger nozzles may be used, thereby lessening the objectionable back-pressure upon the exhaust. Cheaper fuel may be used, other things being equal. More water space around the fire-box may be had, and the sides of the furnace may be inclined sufficiently to take advantage not only of the greater efficiency of the heating surface, but giving the water a better chance to circulate. We also have more space for the ash pan, and can hang it higher to keep it out of the snow and away from the driving boxes. The rigid wheel base can be shortened. It gives better clearance for eccentrics and straps. It makes a better proportioned boiler, when found necessary to increase the diameter of boiler shell or to lengthen the fire-box. The fireman can work his fire to better advantage, and the weight of engine can be more evenly distributed upon the wheels. The cost of keeping up the expansion braces is very much less, and the frames can be taken down and replaced at a very much less expense of time and money, than with the furnace between the frames. Soft coal as well as anthracite is now being used in fire-boxes above the frames."

They asked to have the subject continued, so as to be able to get comparative reports on experiments now going on.

The subject of the relative value of steel and iron axles was continued, the report presented not being satisfactory to the committee. The best part of the report was a sensible letter from John Hickey, of the Milwaukee, Lake Shore & Western road, which says:

"In considering the diameter of a driving axle, we must be governed by the capacity of the cylinder, the boiler pressure, and the diameter of the wheel, as well as the weight per journal. In other words, the diameter of driving axle should be proportioned to the power of the engine, like other parts of the machinery, and this being the case, it will be entirely safe for any customary weight. The diameter of the driving axle therefore should be of such size and strength as to meet the power of the piston, rather than be simply to resist the weight brought upon it. As there is but little difference in the strength of the best quality of iron and a quality of mild steel suitable for axles, there should be little or no difference in their respective diameters when used under like conditions. For engine truck axles, my experience has been that the journals should be of such size as not to permit a greater load than three hundred pounds per square inch of bearing, and that the diameter of journal be not less than 55 per cent. of its length. This rule will hold good for all bearings of railway rolling stock, except locomotive crank-pins and driving axles, the size of which must be in keeping with the power of the locomotive. The wear of journals of course depends on the weight per unit of bearing in contact, and the material of such bearing; a clear hard brass giving less wear for a given number of miles than softer metal. All other things being equal, we find but very little difference in the wear of steel and iron axles."

The committee on brick arches in fire-boxes, report strongly in favor of their use, and recommend as the best manner of supporting the arch:

"First, Freedom from any danger to those constantly employed about the engine by failure of parts, such as are sometimes attended by the use of circulating pipes. Second, One that can be quickly and cheaply, yet substantially put up and maintained, and that is in a measure protected by the arch from the action of the fire. Third, One that will allow the bricks to be removed and replaced with greatest ease and least possible damage, and that will give easy access to the boiler tubes, tube sheet and crown sheet when bricks are removed, and we think that these several conditions are nearer met by some of the methods known as the 'angle iron and stud supports,' and we believe that the best features of some of these might be combined and worked into a support that will meet the requirements of the general service. We are not prepared to recommend the abolition of the circulating pipe, but we suggest the serious consideration of a safer and cheaper method for supporting brick arches than is obtained by their use.

"We desire to call attention to the large number of arch bricks broken in transit and by handling after they are received. This is especially the case where bricks are hauled long distances and when shapes are flat, long and heavy. It has occurred to us that some suitable means might be adopted to strengthen the brick by having iron rods made up in the moulds in such a manner that, should the bricks become cracked or broken through their section, they would be held together and could be utilized, and as soon as exposed to heat in furnace, they would fuse together from the effect of accumulated slag, etc."

The committee on best form and size of axles for heavy tenders define a heavy tender as one carrying about 3,000 gallons of water and 16,000 pounds of coal, and recommend the master car builders' standard axle for cars of 60,000 pounds capacity. This axle is of the following dimensions: Length over all, 7' ½"; between centers of bearings, 6' 3"; collar, ⅝"; length of bearing, 8"; dust guard bearing, 2"; wheel fit, 7¼"; fillet between bearing and collar radius of ¼", between bearing and dust guard bearing, ⅝"; between dust guard and wheel fit, ⅛". Diameter at collar, 5¼"; bearing, 4¼"; dust guard bearing, 5¼"; wheel fit, 5⅝"; behind the wheel the axle is 5¼", with a straight taper to the center, where it is 4⅞".

Committee on subject of preventing corrosion of water tanks recommend the use of good metallic paint, and care of enginemen in using water on coal, but some of the members reported good results from lessening the area of the top sheets exposed to water, and damp coal and cinders. Several roads do this by taking off the flange, and substituting a railing on the larger part of the back of tank, running the back flange across ahead of the manhole; the sloping of the top of sides toward the coal pit also helps, and the entire absence of mouldings around the bottom of the tank prevents corrosion there.

The committee on exhaust nozzles, who were given the rather large contract for finding the relative sizes for nozzles and steam passages in proportion to the size of cylinders, reported that they could find no proportion. They cite the functions to be filled by a successful nozzle as follows:

"It must create draught enough on the fire to make steam, and at the same time impose the least possible amount of work on the pistons in the shape of back pressure. It should be large enough to produce a nearly uniform blast without lifting or tearing the fire, and be economical in its use of fuel." And add:

"After two years of experiment and research your committee has come to the conclusion that, owing to the great diversity in the relative proportions of the cylinders and boilers, together with the difference in the quality of fuel, that any rule which does not recognize each and all of these factors would be utterly worthless. . . .

"The principal question on which the exhaust nozzle practice of the country splits is whether the pipe shall be double or single.

"Those using the double pipe claim that in this way only can the exhaust from one cylinder be prevented from adding injurious back pressure on the other, while the advocates of the single nozzle urge that the use of the exits requires that neither of them shall be central, and consequently the exhaust will not produce the maximum effect, while the single exit, being in the axis of the stack, will produce the maximum effect, and can, in consequence, be made larger and reduce the necessary back pressure.

"Your committee regard neither of these opinions as correct without some qualification. We have found that there is very little difference in the back pressure in either plan, and this is entirely a question of design. So true is this that it is impossible to determine, from the card alone, which type of nozzle is used."

The experiments seem to prove one fact that is not generally known in regard to back pressure on the opposite piston when using a single nozzle.

"Your committee has in some instances reduced the height of bridge to much less than half that of pipe, with no increase of back pressure, and are of the opinion that the most vital point in the design is that the area of each of the two pipes—where they combine—shall in no case exceed that of the final exit, and the indications, so far, are that this area can, with advantage, be made decidedly less than the final one; how much less we do not know."

They leave the subject as follows:

"In view of these facts, your committee feels itself incompetent to advise any plan to determine the size of exhaust nozzle in proportion to any other part of the engine or boiler, and believes that the best possible practice is for each user of locomotives to adopt a nozzle that will make steam freely and fill the other condition named, best determined by an intelligent use of the indicator and a check on the fuel account."

Which is about the landing place of everybody else who investigates the nozzle business very deep. The committee was ordered enlarged and continued for another year.

The committees on testing laboratories, the car coupler question and on the purification and softening of feed water did not report, and were continued.

The committee on subjects for the ensuing year reported the following, which are interesting ones:

1.—Washing locomotive boilers. Methods in use causing the least delay. Washing effect on plates of fire-box while retaining heat from the brick arch. Situation of washout plugs. Describe plan for washing out with hot water.

2.—Best material for locomotive crank-pins, and proportions for same suitable for engines having cylinders 17, 19 and 18, 20 inches in diameter.

3.—Comparative advantages of operating locomotives with different crews on the first in and first out plan, and that of confining men to certain engines; the latter not running a greater number of miles than can be rendered by their regular crews. Discuss any improvements in the method of running engines.

4.—Examination of engineers and firemen in their duties relating to the use of fuel, care of a locomotive, and ability to meet disorder or disability of machinery. To what extent practiced and best plan of conducting same.

5.—Locomotive rods, connecting and parallel. Suitable material for and best form of. Relative merits of solid ends, and those constructed with straps, bolts and keys.

6.—Office dials, most convenient for showing condition, location, in what service, and repairs required, etc., of all engines.

7.—Relative economy and safety of using eight-wheel and mogul type of locomotive for freight and passenger service. It is suggested that the members of this committee be authorized to interview any member or members of the association on this subject, and that it be the duty of all members so required by the committee to appear before them and answer such questions as may be asked. Such questions and answers to form an appendix to the report of the committee.

8.—The subjects of best form of brake shoes for locomotive and tender brakes; the object to find out the wear of flanges on wheels and increase of mileage between turning.

Officers for the following year are: President, John Mackenzie, of the Nickel Plate; 1st vice-president, John Hickey, of the M., L. S. and W.; 2d vice president, Wm. Garstang, of the C. and O.; treasurer, O. Stewart, of the Fitchburg, and secretary, Angus Sinclair, of the *Car Builder*, were re-elected.

NOTES.

The supply men distinguished themselves in the entertainment of the ladies.

Vice-President Griggs stated that his experience with the brick arch dated back thirty-four years. Mr. Griggs' father was the first to use the arch, in 1857.

The next convention will in all probability be held at Cape May, but the hotel that gets to be headquarters will have to guarantee to have a good room for every member who wants one—and that is right.

There were a good many G. A. R. badges worn by the members, who argued peaceable subjects with men who argued against their former visits to the South with guns. Mr. Meehan, of the Queen and Crescent, was one of the engineers on the Merrimac when the Monitor gave her her fatal stab.

One of the best arguments presented in favor of the use of the brick arch was that brought forward by Mr. Mehan, of the Queen & Crescent. He said the arch did more to prevent over-firing than anything else. A fireman cannot make steam when the box is filled with coal up to the arch, and will soon learn that a thin enough fire must be carried to allow of free combustion under the arch.

One of the last acts of the meeting was to adopt a resolution that all committee reports should be delivered to the secretary before May 1st, and printed and mailed to each member before the meeting. If this resolution be carried out to the letter, and no subject discussed that was not so sent out, it would seem as if it might admit of the discussion of the various subjects without reading the papers. Every member ought to be interested enough to study up every subject on the list with which he comes in contact.

Noon hour discussion on topics proposed by members are always interesting. Mr. Forney called out a good many theories, opinions, and the results of observation in his question as to the safety of a pony truck at high speeds. The pony truck is not far different from the leading wheel or single truck as used in Europe on the fastest locomotives in the world. Where the rigid wheel base is not too long the pony truck seems to be safe at any speed, and certainly allows of a better distribution of weight than the four-wheeled truck.

The ride about the city of Richmond was very interesting indeed. The old State house—the first capitol building built in America—is still in use, and contains many interesting relics, for instance, the first iron stove brought to America. It looks more like a Chinese altar than a stove, but it warmed the capitol long years before stoves were introduced. The site of Libby prison, Belle Isle, the oldest house, and the church and pew from which Patrick Henry made his famous speech against the oppression of England, in which he said: "Give me liberty or give me death," all attracted attention.

The excursion over the C. & O. to Richmond was enjoyable, and the visit to and banquet at the Richmond Locomotive Works appreciated. These works are busy on their special lines of machinery; they are building two heavy engines for the C. & O. with cylinders 21 x 24, and ten for the R. & D. 20 x 24, and are rebuilding several; they had four of their pole road locomotives on the erecting pits, and stationary and portable engines were to be seen everywhere. The engines and boilers of the battle ship *Texas* are being built here, and there was a great quantity of heavy pieces in the various departments. The works have just got into the new addition, and any quantity of material, in all stages of manufacture, is piled up everywhere, the new tools are of the best makes and heaviest patterns.

During part of the session, two men sat side by side, whose railroad history would read like a novel, one was John Y. Smith, inventor of the vacuum brake, who served as supt. of machinery of the military railroads of the United States during the civil war, the other was John O'Brien, who served as a master mechanic under the stars and bars, and who took charge of the mechanical end of the enterprise when Stonewall Jackson made his famous raid into Maryland, and captured 38 locomotives on the B. & O., and took them south across the country. Mr Smith was a man of nearly 50 years of age when the war broke out, and had had experience from the very birth of railroads, having at the age of seven been a boy in the shops of the great George Stephenson. Mr. O'Brien was but a boy of 20 or 21 when Fort Sumter pulled down her flag. Mr. O'Brien is still in active service as master mechanic of the Petersburg road at Richmond, while Mr. Smith has long taken matters easy on the fame and fortune he made with his brake, yet he has always been a busy man, and has to-day a new invention in the shape of an exhaust pipe, on the plan of his vacuum-producing apparatus in the brake, that bids fair to be a very useful device. There is no jet black hair on either of these heads now, but all the white ones are honored ones, and no one thinks of giving one more credit than the other for his services—because each did the work allotted to him in the best manner that he was capable of.

Simple Lessons in Drawing.

By ORVILLE H. REYNOLDS.

NINTH PAPER.

The projections of a hexagon nut, as shown in Fig. 54, by which we have three views, and the reasons therefor, were made in harmony with the principles of projection, as explained in its accompanying paper, mention is made of this fact because the process, as touched in that case, is in strict accord with the teaching of high authority. There is another method, however, which has special features to recommend its use, as will presently be shown; a method adopted by draftsmen by reason of a readier understanding of the relation of one view to the other.

By a reference to Fig. 54 we find the top view of the nut placed under the front or side view; this would not be a serious objection in this case, for the view explains itself, but instances occur in practice when it does not make itself clear, as, for example, when top and bottom views are both drawn, and there is such a similarity as to create a doubt of which is top or bottom, making necessary an inscription to cover the situation.

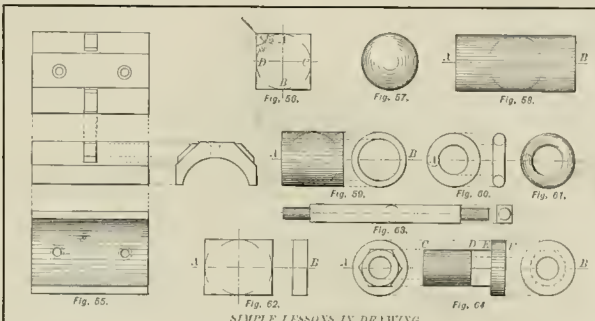
The arrangement of views in Fig. 55 is such that can be no question as to what they are meant to represent. Here the different views are placed on the side from which they are supposed to be taken, as the top view placed at the top or over the side view; the bottom view placed at the bottom or under the side view; and ends arranged at the ends they represent.

The views thus shown are each on the drawing in the proper position to be easily understood, having the advantage over the first method of shortening the construction lines, in projecting the several views from the side view.

This will be clear by referring once more to Fig. 54, where the front elevation is projected from the plan; the lines of projection are shown passing across the front view, which, while serving their purpose, tend to mystify rather than make clear their object; these objectionable features are not present in the method by which Fig. 55 is constructed, for we project directly from one view to the other without passing the lines of projection across the different views.

This method we will use in preference to the first, it being essentially a shop method, while equally as correct as the first.

In general, the side elevation should be drawn first, and the other views projected from it, but this should be decided by the view that has the most detail.



SIMPLE LESSONS IN DRAWING.

All the views of a drawing should be placed in the same position on the paper as the object represented would occupy when in service, so that it would not oblige one consulting the same to stand on his head in order to bring the view right side up. Let the top of the object be drawn so that it is uppermost on the paper; any other position will only bring vexation, of which there is quite enough, without any superhuman effort on our part to woo it.

While it is desirable to show an object in all its parts, and as plain as possible, judgment must be used in drawing those views only really required to that end, therefore, the fewer views shown that will accomplish this result the better.

One view of a cube, Fig. 56, tells the whole story; as does also one view of a sphere when shaded, as in Fig. 57. One view of a solid cylinder explains itself if made to show the length, but then only when line shaded, as in Fig. 58, the one view showing the length, and also that it is round.

When a hollow cylinder is represented, then two views are necessary, as in Fig. 59, when the line shading may be omitted. The dotted lines *C* and *D* represent diameter of the hole, and are projected by placing the T square at the upper and lower edges of the hole on end view, and dotting the lines through side view. To draw Fig. 59, set the compasses to the required radius, and describe two short arcs at any place on the paper, and try with the scale or rule if the arcs are of the correct diameter, if found so, describe the circle at the point selected for the end view; this will represent the outside of the cylinder, repeat the operation for the inner diameter of cylinder by taking the correct radius for same, and the end view is completed, from which the side view can be readily projected with the T square, as explained for the dotted lines.

The trial arcs made with the compasses are necessary, in order to get the circles of a correct size, for the reason that it is largely a matter of guess to take off a radius from the scale or rule, the compasses being liable to overrun or fall short of the graduations on the rule at the first setting; it is easier, therefore, to rub out the trial arcs if wrong, than to erase a complete circle.

A ring cylindrical in section, Fig. 60, is drawn to show the side view, first by setting the compasses as above, to describe the inner and outer circles, when the edge view is drawn by laying off the thickness with the compasses set to half diameter, and describing two semi circles at top and bottom, which shall be tangent to lines projected from top and bottom of side view; perpendiculars erected tangent to these semi-circles give the edge view in outline. The semi-circles at top and bottom of edge view should be taken on the compasses and continued as dotted lines, in order to show the section of the piece, or these dotted semi-circles can be omitted, and a dotted circle shown instead, as at *A* on side view.

This figure would also explain itself without the edge view, if line shading is employed, as at Fig. 61.

An ordinary rectangular object of uniform thickness can be shown in two views, as Fig. 62; these views showing the length, breadth and thickness, arcs for these dimensions to be described from the center line *A B*, as in preceding examples, horizontal lines tangent to the arcs are first drawn with the T square, passing far enough beyond the ends to form the top and bottom of edge view when perpendiculars erected with the triangle, cutting the other arcs, and intersecting the horizontals, will complete the figure.

Fig. 63 represents a square object with a journal on each end, now it is evident that, with the side view alone, and given in outline only, it would be impossible to tell whether the pieces were round or square; when, however, the end views are shown, all is at once clear. The end views can be omitted in this case, if the journaled ends are line shaded as shown, the shading showing that the ends are round, while the body is known to be square from lack of it.

A hollow piece with a round collar at one end, and round body at the other, with a hexagon shaped portion under the collar, is shown in Fig. 64.

The center line *A B* is to be drawn first, on which describe diameter of the collar, also diameter of the hole at *B*; at end *A* of center line describe a circle for the hole, also a circle for the collar with compasses set to those sizes from the other end view. The hexagon across the flats is shown the same size as diameter of end *C*; it is, therefore, delineated by using T square to draw horizontals at top and bottom, and 60 triangle for the remaining sides.

The side view is now to be projected from the last end view completed, first lay off the several lengths, as from *C* to *D*, *D* to *E*, and *E* to *F*, erecting light perpendiculars at these points; the side view can now be completed with the T square, projecting from top of collar on end views to *E F*, and from top of hexagon to *C E*; the center line making the corner of hexagon at the center of the figure; following down with the T square, the bottom outline is made, showing whole of side view, the three views furnishing all information required.

Let us now see if the drawing of this figure can be simplified. If the side view is drawn first, and line shades as shown, then no end views are needed to make the shape understood.

If end view *B* is drawn with the hexagon, and small end shown by dotted lines to bring out the hidden portions, then making end view *A* will be a waste of time, because the side view and end view *B* tell us what we want to know.

Again we can omit the end view *B*, making the end view *A* and the side view answer all purposes.

The side view and two end views made just a plain outline drawing without any line shading on round portions, is perhaps the neatest, and after all the clearest arrangement of this figure; however, there is no better practice than to try the different ways to show the figures as here suggested, not forgetting to imitate as closely as possible the shading of the round portions.

The shading of round surfaces tends to bring them into sharper relief, and, as hinted, if done with care will save making an end view in many cases.

In mechanical drawing the light is supposed to come from the upper left-hand corner of the drawing, as shown by the arrow in Fig 56, which leaves the top and left-hand side in the light, and bottom and right-hand side in the shade.

Round surfaces thus represented come to have a distinct individuality, and are quickly recognized.

A hole is shown with a heavy line at upper left-hand surface, as in Fig. 59.

An end view of a cylinder would be shaded as shown on bottom right-hand edge of same figure. In round surfaces the upper side of side view is shaded somewhat the lightest, because exposed partially to the light, while the bottom surface is darker because in the shade.

The light and heavy lines have the effect of bringing a drawing out clearer cut than they otherwise would be.

Illinois Central Strike.

As we go to press there is a general strike of yard and trainmen on the Illinois Central road. The trouble seems to be local, and not to affect the various organizations of these men as a whole—federation keeps the orders out of trouble here.

A very obnoxious superintendent by the name of Russell seems to have caused all the trouble, and the men demand his removal; this the company's manager refuses to do. They have reinstated those discharged by him, but this does not appear to satisfy the men.

It is a pretty hard matter to decide just how far men are justifiable in carrying a matter of this kind, but there is a limit, and the Illinois Central men are pretty close to it. A man that will try to accomplish anything on a road where all the men cordially hate him has no judgment, and does not look to the interest of the road he pretends to serve—Mr. Russell should resign forthwith and seek new fields.

That class of minor officials who think that to serve the company they must fight the men, are too numerous, and will have to retire; and that class of men who think that, by concerted action, they can decide who shall be their officers, and who shall and shall not be dismissed the service, must also retire.

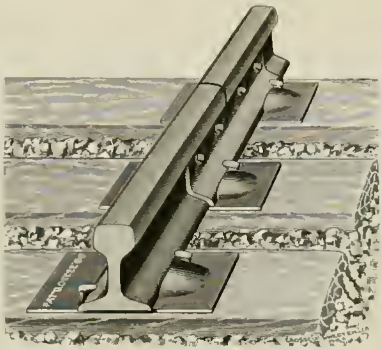
Before Mr. Russell's employment on this line, he held official positions on two other lines running out of Chicago, and the employes of these two lines have notified the I. C. men that they will strike to help them, rather than see Russell win; which goes to show that Mr. Russell is of about the kind and caliber he is represented to be. While the war goes on, thousands of dollars worth of perishable freight is rotting on the side tracks, and ten thousand of passengers are discommoded.

Baldwins are building twenty-five locomotives for the N. P. They will be equipped with the Boyer speed recorder—a device attached to the truck axle.

The Snow Plow Question.

Before the snow plow trials on the Central Pacific road last winter the management had determined to abandon their expensive snow sheds over the Sierra Nevada mountains, and trust to the new plows, but have now ordered all the sheds put into thorough repair. The trials satisfied the managers that, as yet, the sheds are the most reliable. The Cyclone Plow and the Rotary both did fairly good work in the heavy snow, but it would take a million dollars worth of them to keep that road open all the time during another such blizzard. The Jull plow will never do anything until the enormous overhang of the auger and hood is cured; the Cyclone plow has done good work, but has developed some little defects that can be cured. The principle on which it works is good, and its inventor has sense enough to see that it is not perfect and is trying to make it so, asking the practical railroad men of the country to help him. The Leslie plow is doing as well as any of them, but is the oldest, and has been changed a great deal to bring it up—during its first and second winter it was as faulty as any. The perfectly reliable and satisfactory power plow for our Northern lines has not yet been built, and a fortune awaits the builder.

The St. Paul, Minneapolis & Omaha road have an engine in their transfer yard at St. Paul with cylinders 24x28.



An Improved Tie Plate.

The illustration on this page shows an improved tie plate which has no projecting spurs in the wood, and which takes the thrust of the flange upon all the bolts in the plate instead of on the outside spikes; this is done through the medium of the pressed shoulder on outside plate. This plate has a long spike hole through the plate inside the rail; this hole is on an angle from the rail and admits of the inside spike being driven tight against the rail, regardless of variations in width of rail.

These plates prevent the rail from cutting into the ties, and are of especial value in yards where lots of heavy switching is done. On the Western and Southern roads, where soft wood ties are in use, they ought to greatly prolong the life of ties. For further information address C. D. Halsey, Ass't Eng'r M. W., Penna. R. R., Jersey City, N. J., who is president of the Shoulder Tie Plate Co.

A specimen tire and axle has been added to our office museum by the Midvale Steel Co.

The Great Western Railroad of England have on exhibition at the Edinburgh exposition the seven-foot gauge express locomotive, "Lord of the Isles," built in 1851. This engine has 18x24 inch cylinders, a single pair of drivers 8 feet in diameter, a double truck in front and a pair of trailing wheels behind, all having 4-foot wheels. This class of engines were so efficient for express that they were built in this way up to 1881.

Report on Compound Locomotives.

(*Continued from page* 126.)

8th. General.—A recent press notice credits Mr. Webb with an attempt to reduce first cost, by throwing away the valve gear for the low-pressure cylinder, and using in its place a single loose reversing eccentric; in other words, with an attempt to use an invariable cut-off for the large cylinder. And such practice is not unreasonable if it from the first be acknowledged that the compound is designed for doing a maximum specific duty with high economy, and, therefore, the valve gear cannot be, and is not, arranged for a wide variability of service.

This intention in design most clearly marks all those engines using but one valve or one valve stem to distribute the steam to both high and low-pressure cylinders; such, for instance, as the Vauclain piston valve, the Woolfe hollow D valve, and the Dunbar single valve stem. In the two first-mentioned most ingenious valves, the release of the high-pressure cylinder must be at the same moment as the admission to the low-pressure, or it is no actual release, and the cut-off in the low-pressure cylinder marks the exact point when compression in the high-pressure cylinder commences, there being no appreciable "receiver" capacity in the valves themselves, large as the passages through them have to be. There is, then it, is clear, little elasticity of adjustment in such valves and gears. The cut-off being early in the small cylinder, it must be early in the large, and, as a result, the compression in the small cylinder is enormous. Thus the conclusion is again brought home to us that the control of the compound, when small horse power is to be developed, must be chiefly through the throttle wire-drawing the steam, and thus reducing the initial pressure.

Putting emphasis on this truth will not frighten those who are familiar with the fact that wire-drawing is common to-day with our best enginemen. And it may here be noted that the *imperative necessity* for this so-called "crude practice" is the full explanation for the slight use in modern locomotives of screw and other finely divided reversing gears. This statement opens up the whole matter of cylinder condensation, but it is too large a matter to be properly treated in this report.

However, such modern experimenters as Westinghouse, Kennedy, etc., prove that wire drawing the admission into cylinders of large surface and small volume is more economical than valve cut-offs at less than 50 per cent. of the stroke.

There are some constructive details and peculiarities about compounds that may deserve special mention. For instance, it is judicious to put safety or relief valves on the low-pressure chest or cylinder, but they should be so located or guarded that in case they came into action they should not smother the engineman with steam, and obscure his vision. All types do not require water taps on both cylinders, but most receivers should be so drained. If an intercepting valve is used, a reducing valve is not required, and if an intercepting valve is not used, there must be a valve to give independent exhaust direct to the atmosphere from the high-pressure cylinder. The weight of evidence, so far, is in favor of the use of an intermediate receiver. Such a device effectually isolates the cylinders, so that each retains its distinctive temperature. The general practice of drying the intermediate steam by putting the receiver in the smoke-box has much to recommend it. Copper pipes, set close to the curve of the smoke-box, are not cumbersome or much in the way; and if it be desired that the feed-water also be heated in the smoke-box, the large receiver pipes need not interfere with the details of such an arrangement. Receiver capacity cannot, under our limiting conditions, be too large. It should never be less than 1½ times the volume of the high-pressure cylinder, and two or more volumes are desirable, because, with a liberal receiver, the steam supply to the low-pressure cylinder is more uniform in pressure and amount, the re heating or drying of the steam is more thoroughly done, and "the drop" in pressure between high pressure final and low pressure initial is less detrimental to steam economy.

If one side of a compound should break down, the other side can be run as a single cylinder engine, if the failure is not due to a total collapse of the cylinder on the side to be blocked. And in a tandem, as in a simple engine, the failure on one side may be a total collapse without its interfering with the use of the other side as a single engine.

J. DAVIS BARNETT,
JOHN PLAYER,
H. D. GARRETT,
F. W. DEAN.

Mr. Wallace, who is introducing the Partington metallic packing in the United States, is meeting with marked success in the way of having the packing intelligently tested by a number of our largest lines. An article of merit only needs a fair test.

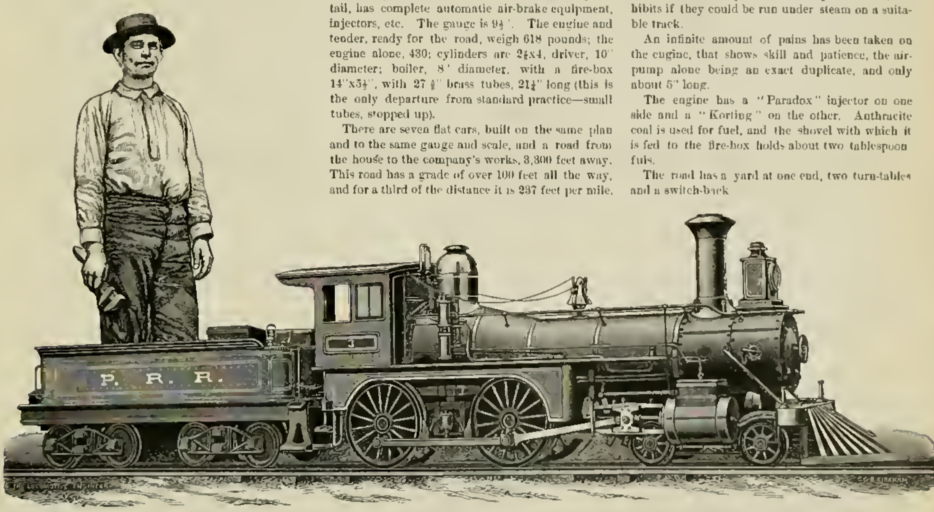
THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 8 | NEW YORK, AUGUST, 1890. | $1.00 per Year or 10c. a copy.

The Smallest Locomotive in Service in America.

The illustration on this page represents and gives some idea of the proportionate size of a very small locomotive, yet one capable of doing considerable work. As will be seen, the engine is an exact copy of a standard P. R. R passenger locomotive, but is just one-sixth of full size.



GULLIVER AND THE LILLIPUTIAN.

Some years ago Daniel Coxe, a son of one of the firm of Coxe Bros. & Co., who own and operate extensive coal mines at and in the neighborhood of Drifton, Pa., took it into his head to build a locomotive. Probably the notion came there from his ancestors, as he is the grandson of Richard Norris, the once famous builder of American locomotives. As he had access to tools and material in the company shops this was not hard to do, and he soon turned out a rather expensive toy, yet one that sharpened his appetite for something better. A year or two afterward No. 2 was made. She would move under steam—and that was about all.

Young Coxe made up his mind to build another locomotive that should be just like a large one, excepting as to size, and see if it would not do work in proportion to its size and weight.

A very neat little shop was fitted up at home, with a planer, shaper, drill and several lathes, and work commenced, building exact to standard drawings, only on a scale of 2" to the foot.

He then secured the services of A. J. Beltz, a machinist with a bent for small work, and whose picture is shown beside the engine.

In 1887 this engine was turned out, and a road built for her, and she has been in use there ever since, making between 2,500 and 3,000 miles.

The engine in the picture is perfect in every detail, has complete automatic air-brake equipment, injectors, etc. The gauge is 9½". The engine and tender, ready for the road, weigh 618 pounds; the engine alone, 430; cylinders are 2⅝x4, driver, 10" diameter; boiler, 8" diameter, with a fire-box 14"x5½", with 27 ⅝" brass tubes, 21¼" long (this is the only departure from standard practice—small tubes, stopped up).

There are seven flat cars, built on the same plan and to the same gauge and scale, and a road from the house to the company's works, 3,300 feet away. This road has a grade of over 100 feet all the way, and for a third of the distance it is 237 feet per mile.

The entire line is equipped with semaphore signals, and the regulation Lehigh Valley switch-stands and targets. The rails are the lightest rolled, and much too large for the engine. They are 8 pounds to the yard.

A cushion that fits the top of the tank allows the runner to lay partially upon the tank and partly on the first car, the cab being just about large enough to get a man's hand into with comfort.

With four or five men on the cars the little mill soon gets up a speed that makes you want to keep up your legs and look out not to strike passing objects. She has taken twelve persons over the road at once.

With 140 pounds of steam the engine started from a dead stop and ran 2,500 feet to a dead stop again, in 1 min. and 40 sec.—over 20 miles per hour.

The engine does no particular good, perhaps, is of little use, you may say, yet it teaches a lesson in what can be done if done well. There are no bent wires or makeshifts for the engine; there is nothing on a big engine that is not to be found on this, and she does work just in proportion.

Mr. Coxe now has another and slightly larger engine nearly completed. She is modeled principally on the "Class K" engines of the P. R. R., and he expects to exhibit both of them at the coming world's fair. They would be very interesting exhibits if they could be run under steam on a suitable track.

An infinite amount of pains has been taken on the engine, that shows skill and patience, the air-pump alone being an exact duplicate, and only about 5" long.

The engine has a "Paradox" injector on one side and a "Korting" on the other. Anthracite coal is used for fuel, and the shovel with which it is fed to the fire-box holds about two tablespoonfuls.

The road has a yard at one end, two turn-tables and a switch-back.

The smallest road we know of that is open for public business is the two foot-gauge road of the Monson, Maine, Slate Company, which is six miles long, and hauls six tons of freight per car, doing a business of 9,000 tons in 1888, and carrying 4,200 passengers.

A person seeing young Coxe and his little engine sailing along up through his father's orchard would think for a moment that he was looking into the big end of an opera glass, at a Pennsylvania construction train on the other side of a wide valley.

Down South many of the old timers refer to the blocks placed over driving-boxes, in case of a break-down, as "Confederate springs." During the war springs were not to be had in the Confederate States for love or money, and as fast as they were broken in service, blocks of wood took their places, and were nicknamed "Confederate springs."

Ft. Wayne Shop of the P., Ft W. & C. Ry.

(Editorial Correspondence.)

The general shops of the Ft. Wayne road are located in the city of Ft. Wayne, Ind., and are quite extensive, and as modern as usually found in shops of their age.

The buildings are of brick, substantially made, and, while there are a few old tools, most of them are modern and up to date.

PIECE-WORK.

Here, as at many other of the Pennsylvania company's shops, most of the work is done by the piece, and this alone brings out a great many short cuts and hurry processes that cheapen the work and get it out of the way. Piece-work has many advantages and some disadvantages, and is, no doubt, more valuable where manufacturing is done than in repairs; but I am not going to discuss its merits and demerits. I went after

SOME KINKS.

There is no plate planer in the shop, yet they plane plates of any size. This is done by an attachment to a large planer. An old planer table was set up beside a large planer and leveled with its bed; then the cross-rail of the old planer was securely fastened on two brackets bolted to the end of the table, and the head carrying the tool-post fitted to it. When a boiler plate is too large to be placed on the planer table it is fastened upon the old, stationary bed, beside the planer, and the tool on the end of the big planer table travels along and trims the sheet as wanted. This tool does nice work, does it well, and for two cents per foot, as against ten or twelve cents for hand work. They have invented and are using the best form of

SIDE PLATES

for taking up lateral motion in driving boxes and axles I have ever seen. Instead of making the plates of iron, cutting them in halves and tap-bolting or riveting them to the hubs of drivers with copper, they make them of phosphor bronze, in one piece, without bolts. They turn a recess in the side of wheel center, as shown in sketch, making an inclined shoulder as at 1, and a similar shoulder on the axle as at 2. In half a dozen places around this circle they chip off a piece of the inclined shoulder, as shown at *a*; this keeps the plate from turning around. This turning once done never needs touching again to fit new plates. The wheel center prepared, the axle is set perpendicular, and the outside of the circle built up with clay, and the place poured about ⅛ of an inch above the finished size with a good quality of phosphor bronze. As this cools it shrinks and binds solidly against the two inclines 1 and 2, which holds it solid against the hub, and the notches prevent its turning around. All that is necessary is to put the wheels in the lathe and face off this plate. It wears well, and can be very cheaply replaced, and there are no bolts or rivets to work out and cut the box. When one of these plates is struck with a hammer it sounds like the wheel center itself—it is there to stay.

LIVELY WORK

There are no slow moving machines here. Milling is done with a generous cut under a solid stream of water. Rods, guides, guide yokes, frames, etc., are sent to the machine shop just as they come from the steam hammer, and without any attempt at finishing up by blacksmith. In the room devoted to axle work and bolt cutting all the bolt cutters have been speeded up, the double-head bolt machines are cutting on an average 1,500 bolts per day as against 700 before speed was changed. On all this class of work they use a special brand of cottonseed oil that they think especially good.

CHEAP WORK.

In this room car axles are turned for 20 cents each, which is the cheapest I have heard of.

TURRET-HEADED LATHES

are employed on small iron work that is got out in large quantities and in duplicate, and, of course, the price is kept way down.

THE BLACKSMITH SHOP

is especially well equipped, and there seems to be more ingenious tools here than in the rest of the shop. Special dies for almost every piece forged are in use, the bolt forging machines being made to turn out bolts of peculiar patterns and pins with keyholes all punched out at one blow. They make crown bar bolts that are finished under the head on a taper, and so nicely that they go into the boiler without machine work or copper washers; the tools for this work are very ingenious, insuring as they do exact uniformity in the work turned out. On the

GUIDE YOKES,

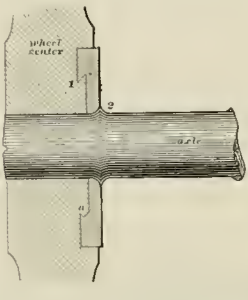
which are large, and slotted for the main rod, they save time and money by cutting the iron out of the solid, and making three welds in it instead of bending the yoke, as is usual. The welds are at each corner, and at its center under the boiler, very little work is done aside from the welds until they go to the machine shop.

THE PLANING MILL

has recently been re-arranged so that every piece of timber does through it for all work, no material having to go back once it is in the mill. All the tools are served with hoods, and exhaust fans take out shavings and sawdust, the sawdust goes to a house for its storage and the shavings go by another system of piping to the boiler-house, or the dust-house, as wanted.

CAB-DOOR KINK.

All the front doors of their cabs open out and swing from the outside corner. On the corner of the cab, and extending ahead about four inches,



there is a cast-iron bracket that holds a plug of soft rubber for the door to strike against; the door is held open by a long hook that drops into one of a series of holes in an angle-iron fast to the inside of the cab below the side window. When the door is wide open this rubber has to be compressed in order to hook it open, and this keeps the door from rattling. Right in the center of the glass of the front door, and about on a level with a man's eyes, there is a little glass some four inches wide and extending across the door, that is in a frame of its own and hinged from above to swing out. This is used to admit a little air without many cinders, and for the men to reach out of to clean snow off the glass.

AIR WOULD BE BETTER.

For driving the cylinder boring bar, valve seat, planer, etc., a small engine is used and steam is taken from a system of pipe for it. The use of steam calls for the piping away of the exhaust and the use of hot pipes where every leak is noticeable and annoying. Compressed air would be cooler and cheaper to use, as it can be carried long distances in rubber hose, requiring no pipe work, the exhaust taking care of itself, and allowing of the moving of the engine.

THE BOILER SHOP

is pretty well arranged and busy on Belpaire boilers, a form now much used by the Pennsylvania Railroad.

ENCOURAGE INVENTION.

This company encourage their men to improve tools and processes, and there were several new devices in course of erection that I shall write of in good time. When a device is gotten up by one of the men that seems to have merit it is tried, and if found good, adopted. The company pay for having it patented, and often a good bonus for its use as well; then the inventor has the patent to dispose of to other roads.

A CAR DRAFT GEAR

was recently invented here by General Foreman Graham, and is now being applied to all freight cars built. G. H. Judy has charge of the blacksmith shop and can well be proud of his special tools. George L. Potter, the master mechanic in charge of this shop, is a young man and one of the many bright graduates of the Renovo (Pa.) shop.

J. A. H.

Helping the Engineer.

No good fireman ought to let his engineer do any repairing on the road that he does not have a hand in, and learn how it is done. There should be a feeling of fellowship and a disposition on the part of both men to see that all the work to be done about the engine is done well and to the best advantage. A fireman should be willing to help pack or oil around, or the engineer be willing to help clean the fire when in a hurry on the road, and his own work is done.

Of course the fireman will help the engineer more than the engineer will the fireman—one is anxious to learn the business, the other is supposed to have learned it.

It often happens that a particularly helpful fireman will entirely spoil an engineer who is so built that his constitution will stand considerable rest. "Follow me around with a wrench and the tallow pot," is an old gag used to illustrate their ways.

The writer has in mind a rather young runner, who got so bad this way that he needed a porter to wait on him, his firemen were asked to do everything, and they finally began to figure to get changed off—particularly as the engine ran by this man got to steaming badly. We had one bright boy firing on the road that cured the restful runner in one trip.

Harry was rustling for steam pretty hard, and was tired, having done all the oiling, switching and other work on the trip. When well out on the road, about the middle of the division, the engineer took a chew of plug, and smiling at the sweating youth, who was worrying over the position of the pointer, said for the tenth time:

"Son, you are younger 'en me, git me a drink, won't yer?"

Harry slid off his box, slammed in three or four shovels of coal, set his shaker bar on the stub, took down the wash bucket, drew it brimming full of water, put the tin cup into it, and set it over in front of the eagle-eyed steersman, saying:

"Just help yourself, I'm awful busy now."

The Pennsylvania's New "Class P" Engines.

The P. R. R. have just turned out another series of the "Class P" engines, such as illustrated in our issue of December last. These have a larger cab than the ones shown, which was badly needed, the piping has been arranged a little better, and they are more comfortable. A man can take off a plate on the back board of the cab and pack the throttle, which is easier than taking off the cab, which almost seemed necessary before.

The greatest change is in the location of the engineer's brake valve, which has been placed on the fireman's side and connection made to it by a reach rod and a couple of bell cranks—this is a doubtful improvement. There seems to be a prevalent idea that this valve must be on the boiler-head somewhere. The Erie plan of placing it below the footboard, with the stem extending up like an old-fashioned lazy cock, and carrying the handle and stops, is a cheaper and better arrangement than this.

The cylinder cocks and sand valves are operated by good-sized and conveniently located levers on the side of cab.

The ash-pan slides on the last series, operated by rack and pinion, have not been a success, as they stick and become inoperative.

Simple Lessons in Drawing for the Shop.

By ORVILLE H. REYNOLDS.

TENTH PAPER.

It is not always the case that an object can be shown thoroughly and clearly by the elevations and plan alone, even when hidden parts are made as plain as possible by means of dotted lines. Often it will be found necessary to resort to sectional views, as hinted in a former paper; indeed, it will be preferable to make the sectional views, rather than have the drawing confusing by too many dotted lines, as is too often the case.

An intelligent use of sectional views goes far toward making a drawing easily read and understood. A section is intended to show the interior of a body, and is a longitudinal section when cut lengthwise through its center in either a vertical or horizontal plane; a cross or transverse section when cut through crosswise. When sections are made at different angles they are said to be oblique.

These terms we are not tied to in practice, however, since a section can be, and often is referred to as a section on any line, as A B, etc. It is, therefore, a matter of no special consequence whether the section is longitudinal or transverse in most cases, so that the letters of reference convey the information of where the section is taken from.

Fig. 65 represents a crosshead of a locomotive engine having guides of four bar type. The plan or top view is drawn first. The center line A B having been drawn, describe arcs on each side of it, representing lines to be drawn with the T square. The lengths can then be laid off, beginning with the ends, after which draw the keyway, then the solid end through which keyway is shown, and finish the view by drawing the pin or journal, and the half collars next to the pin. The plan thus delineated is complete.

Next project the end lines of plan to any point below the view to form the ends of the next view, the center line of which is to be drawn at a convenient distance from the plan, as at C D. Describe on each side of center line arcs to represent the thickness of crosshead, and draw with T square to intersect lines forming the ends. This outline as shown would represent a side elevation if completed, but the question here presents itself, Will a side elevation show what is wanted as clearly as a section?

When it is considered that a front view is to be drawn, and that it will show the wings of the crosshead as well as a side view, we can decide that a side view can be dispensed with, and substitute for it a sectional view.

After an examination of the plan, it will be evident that the center line A B will be the proper place from which to take the section, for the reason that it will give more detail in the section than any other point that could be chosen, it showing the diameter and taper of hole for piston fit, and also the width of keyway with its taper, which would not be the case if the section were taken elsewhere; therefore the line A B shall be the place at which the plan is supposed to be cut.

All points lying in the same vertical plane on the plan may now be projected to the sectional view. The points to be projected are, the edge of half collars, the center line of journal E F, the inside end of piston fit, and large and small ends of keyway. The taper of hole for piston fit is next laid off each side of center line and drawn, the points projected for top and bottom of keyway then connected, leaving the front line square with the center line, and the rear line slightly angular for the draw of key. Nothing now remains to complete this view, except to describe at the intersection of lines C D and E F, the circle for the pin or journal, and the semi-circle for half-collars, after which the portions supposed to be cut are section-lined with the 45° triangle.

We have here a longitudinal vertical section representing the crosshead as it would appear were it to be cut on the line designated, and the upper half turned toward us so as to bring into view the cut surface.

The front view is next drawn by projecting from the plan the lines representing the width of the crosshead, both of the top and wings, after which the center line K L is to be drawn, and from which the thickness of body and wings is to be laid off. At the intersection of center lines, the circles representing the large and small diameters of the piston fit are to be described, and the front elevation is completed.

To still further illustrate the subject, let us make one more section. Supposing the crosshead to be cut on line I J; this will give us a transverse section looking toward the journal.

In order to draw this section, produce the top and bottom lines of longitudinal section a convenient distance, also the center line, and erect a perpendicular at such a distance from the section already made as will bring the proposed section in the same relation to the one made as the latter is to the plan. This suggestion is made so as to have a well-ordered arrangement of views, and should be observed in all cases when grouping views.

The thickness having been determined when the top and bottom lines were projected from the first section, we will take for a center the intersection of center lines, and setting the compasses on the plan at intersection of the center lines, take the distance over wings, and transfer the same to proposed section; then take length of journal from the same point on plan, and transfer that dimension also, lastly take the radius of journal, and lay off each side of center line. All that now remains to complete the view is to use the 45°-triangle for the section lines.

The crosshead, as represented, is supposed to be complete and ready for service. The pattern maker would regard the drawing as showing finished dimensions, and in making the pattern would allow for shrinkage and finish; by finish is meant the material to be removed in the turning, planing and boring.

After the casting is made, the operation of "laying off," or putting on the lines for the guidance of the lathe and planer men, is identical with the drawing of it, except that in one case we make our lines on paper with a pencil, and in the other make them on the iron with a sharp scriber, after the application of chalk to the rough surface. The surface plate will take the place of the drawing table, and the try square and surface gauge will do duty in place of the triangle and T square. The results are the same in both instances, with a trifling difference in the method of their attainment.

The center lines are the points from which all dimensions are to be laid off, same as when making the drawing.

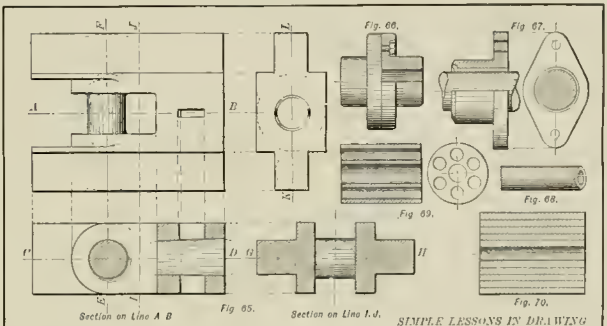
Intersection of center lines at sides forms the centers on which the journal is to be turned, intersection of center lines at end locates the center of hole for piston fit, the core of which, by the way, should have a piece of pine neatly fitted, having a tin center, from which to describe the circle representing the hole for piston. From this center another and larger circle should be described, by which the crosshead is set true in the lathe when boring the hole. This last operation, and laying off the keyway, is deferred until the crosshead is planed in many cases.

Much latitude is taken in the matter of sections, as, if it is desired to show the interior of merely one special part on a drawing, it is done by showing it cut away at the particular place to be represented, and not carry section through the whole plane where shown. A reference to Fig. 66 will convey the idea. Here we have a flanged coupling for shafting, shown with one-eighth of the figure cut away, giving enough detail in the one view to make its construction plain, as is sometimes done when the parts are shown assembled or in position, thus saving a detailed drawing of the object.

Fig. 67 represents a piston gland, with all details complete in a half-longitudinal section. Here we have the cast-iron body, with a brass bushing, and piston rod shown broken. The front elevation shows section lines where the hole should be. Now, as a section is meant to represent a cut or broken solid, those lines are intended for the broken piston, and not the hole.

Instances are recalled in which the holes have been cross-hatched or section-lined, but no argument is needed to show up the practice as a failure and misleading.

The view of a broken tube, in Fig. 68 shows an oblique section. The principal use of view like this is to show that it is a tube, or hollow. If it were not broken at an angle, and if no end view was shown, it would look like a solid cylinder, as made, it tells at once what it is.



SIMPLE LESSONS IN DRAWING

Fig 69 is a section and end view of a cylinder, with perforations in the direction of its length. A transverse section would show just the same as the end view, therefore it is not necessary. The longitudinal section and end view give all information needed.

In Fig. 70 is shown a number of concentric bands in sections, the section lines running in opposite directions on adjacent sections. A good effect is brought out if the 45° triangle is used on alternate sections with the 60°-triangle between.

In order to avoid a shabby appearance in a sectional view of this or any other kind, it is well to exercise care in drawing the lines to the edges of the respective sections, being quite sure that the pencil or pen does not pass by the outline of section.

In the spacing of section lines there will be found a big field for practice. While it is of no consequence how much the spacing of lines may differ on adjoining sections, they should be at a uniform distance on each individual section.

The United States now produces 26 per cent. of all the iron ore that is mined, 26 per cent. of all the coal, 30 per cent. of all the pig-iron, and 32 per cent. of all the steel that is manufactured. The world's annual production of iron ore is placed at 53,280,000 tons, of coal, 462,000,000 tons, pig iron, 24,869,000 tons, steel, 10,513,000 tons.

At the Brooks Locomotive Works.

The Brooks Locomotive Works, at Dunkirk, N Y., are the only works of the kind in this country, unless it be Cooke's new shop, that are all on the ground floor. These works were established over 20 years ago by H. G. Brooks, who for many years before had charge of the motive power of the Erie; in fact, the Erie shops were at first used, and afterward purchased from the road.

The shop room seems ample, except in the foundry, which is very crowded, but plenty of ground is at hand for extensions when needed; a new tank shop is now being put up over the old one.

The machine shop is well supplied with tools, most of which are of late design, the heavier ones being well served with cranes.

They have recently put up a large combined miller and slotter, imported from England, that is a very fair illustration of what use "combination" tools are in a manufacturing business. One side at a time is all that can be used, the tools are "combined" on one base, not to do work together, and to change from miller to slotter or *vice versa* is a job requiring more time than needed to transfer the work to another machine twice over. The machine was doing nice work as a slotter, and most of the gears and other extra paraphernalia of the miller part, rested quietly against a post out of the operator's way. This is the day of special tools, and not combinations. This kind of a tool might be a nice thing for some small, isolated railroad that had a little of each kind of work to do.

The different kinds of work in these shops has been separated into different rooms and buildings, so that there is little confusion, and tools for certain work are close to each other. There is a separate shop where cylinders are finished, where frames are made, one for rod work, another for tanks and the same for trucks.

The boiler shop is well supplied with tools and has a very large traveling crane, having a bridge 80 feet in length. Hydraulic riveters and some steam riveters are used, but these will soon be replaced with hydraulic tools; many of the heating forges, such as rivet forges, are heated by oil, which gives a clean, hot blaze, free from sulphur and dirt

A very elaborate hydraulic plant has recently been added to the works; water is supplied under several hundred pounds pressure by a compound pump, and will be used for every purpose where it is practicable. This plant was made by the Dunkirk Engineering Company.

The blacksmith shop is nicely arranged, every fire has a large hood, and the smoke-pipe makes a turn and enters an underground flue connected to the stack; draught is created by exhaust fans. By this arrangement there are no obstructions overhead, and cranes and trolleys have full swing.

There is here a very nicely arranged case hardening furnace, designed by Mr. Brooks, and a great deal of case-hardening is done; equalizers are milled out where spring hangers come and case-hardened; in fact, any and every piece subject to wear that can be case-hardened is so treated.

There is a separate building in the yard, isolated from the others and having no windows; this is for the storage of templates, of which there is a great accumulation, as templates are made for all work.

The tool room is well provided with tools, especially grinding tools, and all reamers, twist drills, taps, dies, and lathe tools, are made here, they claim a saving of 50 per cent in the matter of twist drills alone. All lathe and planer tools are ground to gauge by use of a Sellers' tool grinder, and no trips are allowed to the tool dresser or the grindstone.

The shops are full of work, so full that no orders are taken for this year's delivery, and it is a noticeable fact that they are building no "specification" engine—that class of work where the order calls for just such a bolt and such a thread in each particular place. All the engines going up are Brooks engines.

On some of the larger boilers a double row of rivets is used in the mud rings, clear around; butt joints are avoided in longitudinal seams and triple riveted lap joints used.

Unless otherwise ordered all engines have the Morse balanced valves.

On their tanks they extend a narrow flange around the front of each tank head at the gangway; this makes all the water that comes ahead on the top of tank run into the coal space instead of the gangway.

The drawing room is pretty well crowded just now and larger quarters are being planned.

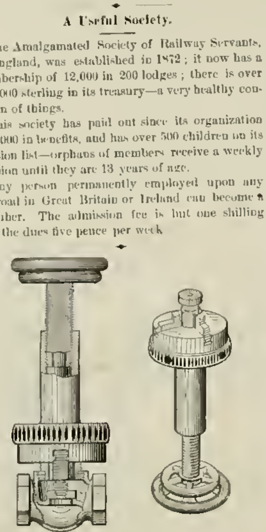
In the office building is the famous Brooks Technical School, not only free to every apprentice boy in the shop, but obligatory—he must attend. Books, drawing material and teachers are furnished by the company entirely free; all the boy has to do is to attend. Three years of apprenticeship and schooling generally turns out a mechanic who is able to take hold of a foremanship or other position of responsibility, with some show of going to the top. This free school is an inducement to the better class of boys, and the result is that the works secure the services of intelligent and earnest workers. Their apprentices are drawn from nearly every State in the Union, and one boy from England and another from Cuba were pointed out to us.

A Useful Society.

The Amalgamated Society of Railway Servants, in England, was established in 1872; it now has a membership of 12,000 in 200 lodges; there is over £70,000 sterling in its treasury—a very healthy condition of things.

This society has paid out since its organization £60,000 in benefits, and has over 500 children on its pension list—orphans of members receive a weekly pension until they are 13 years of age.

Any person permanently employed upon any railroad in Great Britain or Ireland can become a member. The admission fee is but one shilling and the dues five pence per week.



A New Valve Reseating Tool.

The accompanying cuts show the design of a neat and handy tool for reseating valves, that seems to possess especial merit as a tool on locomotive repairs. Being portable and small, it admits of being carried to an engine and adjusted without taking a leaky valve off, and is applicable to angle or globe valves, and will work equally well at any angle or in any position.

The body of the tool is a small chuck with three expanding jaws, the face of the jaws being threaded so as to engage with the threads in a wide range of sizes of valves. These jaws once in the threads of the valve, hold the chuck true without possibility of cramping. The extension on top of the chuck carries a feed sleeve that feeds the tool down, by one handle—the smaller of the two handles shown—and this sleeve carries a spindle free to turn. The top of this spindle carries a hand wheel, and the bottom a cutting tool or rose bit, this tool, being removable, a variety of sizes and shapes can be used.

After adjusting the tool on a valve it is but the work of a moment to make a new seat.

The address of the inventor is, Charles L. Morse, Athol, Mass.

Wanting to Know that which is Other People's Business.

The Central Railroad of Georgia recently sent out a personal record sheet, that for gall and impertinence is fully up to the standard, if not a little ahead of it. Here are some of the questions.

1. Full name?
2. Born? In what city or town, State and month, day and year.
3. Height and weight?
4. Married or single?
5. Residence of family or relatives?
6. State of health?
7. State if insured. In what companies, and for what amounts?
8. State if eyesight and hearing is good or defective, and how?
9. State experience, if any, in railroad service other than this road, giving capacity of service, time, and with what road?
10. State if discharged from service, as above, cause, and from what road?
11. State where last employed, capacity, time and cause for leaving?
12. Give names and address of parties to whom you refer?
13. Were you ever employed by this road, when and in what capacity?
14. Were you ever discharged from this road, for what cause, and when?
15. Will you study the rules governing employes on this road carefully, keep posted and obey them? If not promptly furnished with a copy of rules, will you apply to the head of your department for them at once?
16. Do you know that bridges, including highway bridges, and tunnels, overhanging roofs, etc., on this system, are too low to clear a man standing on a box car?
17. Do you know that there are many structures adjacent to the tracks on this system, and particularly bridges and tunnel walls, water tanks and spouts, overhanging roofs, wood racks and platforms which render it unsafe to climb up or down the side of a box car while the cars are in motion?
18. Do you know that the coupling and uncoupling of cars is attended with great danger, in spite of all precautions of the company; that the company hauls the cars of other roads as well as its own; that drawheads are of different heights, sizes and patterns, and that some cars have dead blocks and others not, and that altogether there is great lack of uniformity in coupling and buffing apparatus?
19. Will you abstain from the use of intoxicating drinks while in the service of this company?
20. Will you keep away from the places where it is sold, and lend your influence to help others do the same?
21. Are you now, or have you at any time, been disabled from any cause?

There is also a "minor's release," the parents releasing and forever acquitting the company "from any liability for damages for any injuries which may be sustained by said minor while in its employment." The release also provides that the company "may pay all wages and other moneys" to the minor.

Some of the questions are all right, and should be answered as a matter of record in case of accident, but numbers 2, 3, 4, 6, 7, 10 and 11 are private matters, and concern the company no more than does the color of the subject's great grandmother's hair.

Questions 13 and 14 should be matters of record on the road.

Questions 16, 17 and 18 are damaging confessions of the maintenance and use by this company of death-traps, and the answering in the affirmative of these questions was intended to put the responsibility of death or injury from the causes mentioned upon the victim of these traps, rather than upon the company. If there are railroad commissions in the States traversed by this road, this should be a pointer for them—some changes and repairs are needed. The minor clause is a sneaking plan to avoid damage, should a minor be killed by some of the traps set by the company. It would look much better for this great corporation to ask the men to point out such places as would not clear men on top of cars, etc., that they might put them in safe working shape, than to ask the men to take all the risk, and hold the company blameless.

The Central has evidently got some official with very little to do.

The temperance questions are all right enough, but how much better number 20 would look if it read "Will you keep away from places where it is sold, and assist and emulate all the officers of the company, by individual example, in helping others to do the same." Probably the very official who schemed up this clause drinks more liquor than the average of his men.

The men on this road very properly declined to answer some of these questions, and the company has withdrawn them—and it is well they did. The men now ought to demand that some of the traps set in their paths be removed—the road is dangerous enough at best.

Engineer Benj. Hurst, of the Erie, died last month; he had been an engineer for 51 years.

A Big Engine.

The largest Corliss engine ever erected has recently been turned out by Hick, Hargreaves & Co., Bolton, England. This engine is a double one, each cylinder developing 5,000 horse-power; it is of the vertical type and stands 48 feet high. It will drive a dynamo 45 feet in diameter, supplying a current of 20,000 volts. Some idea of the size of this engine can be had from the sizes of minor parts; the bolts through the straps of the connecting rods are *nine* inches in diameter.

Cause and Effect.

The passenger and freight agents lay awake nights to devise schemes and excuses to cut rates below living figures, and then the stockholder—who, like the storied Jew, must have his pound of flesh—demands retrenchment in the shape of a cut in pay, shorter hours or a reduction of the shop force.

The men who own most of the stock of American roads seem to pay very little, if any, attention to the condition of their properties or the management into whose hands it is placed, so long as they pay dividends.

After a season of "economy" and "retrenchment" of this kind a change of managers and a cessation of dividends has to be had to get the property back into a fit shape to operate and restore in the public, confidence enough to get them to ride over the lines again and pay fare.

A Compound Design.

Geo. L. Flertz, of Detroit, sends us a sketch of plan for compound locomotive, recently patented by a Pennsylvanian, in which the low-pressure cylinder occupies the place now occupied by cylinder of a simple engine, and the high-pressure is located back of it, the crosshead playing between them on a common piston, and asks an opinion on it, especially for 10-wheeled engines.

The design is complicated and entirely impractical; the pair of cylinders could not be got into a space of less than 8 feet fore and aft, and the high-pressure cylinder is in the way of the main rod, requiring an offset in the crosshead and crank-pins, long beyond reason. Such an engine has more parts, greater weight on truck, extra valve gear, extra steam piping, would cost much more to begin with, cause enormous friction and wear, and consequently cost more for running repairs—a worse arrangement could hardly be devised.

An Improvement in Car Seats.

The ordinary reversible back seat has had a pretty long run on American roads, because of its reversible adjustment, but it has a number of disadvantages that are well known.

In the first place the back has to be light and strong, is limited as to height, and being hinged to the seat ends, it cannot be taken out for cleaning. Seats are reversed in order to throw two together either for parties, or for the baggage or feet of hoggish travelers. On the western trunk lines running through cars over 1,000 to 2,500 miles of road, there is a great temptation to make beds of seats by removing and changing seat cushions.

The invention here illustrated consists of stationary standards supporting fixed backs, while the seat itself is reversed by swinging it on its support, and using the opposite back, as plainly shown in the drawing.

The backs are double, and upholstered on each side, and can carry a head rest such as used in reclining chair cars, the back can be inclined either way by the use of notches shown on the standard, and can be lifted out of its place to be beaten and cleaned.

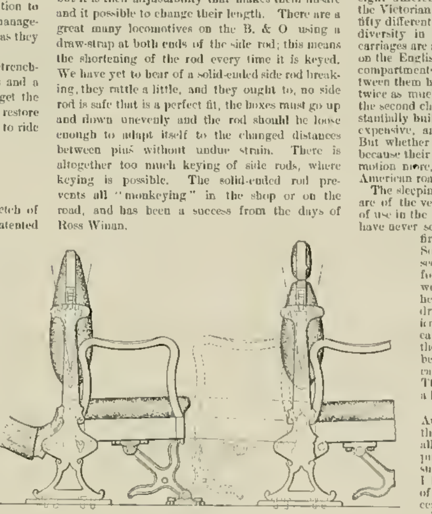
The swinging seat is held at the center and front by its supporting link, and at the back by the foot-rest.

This arrangement secures to each passenger a degree of privacy not possible with the reversible back seat, as it admits of his riding with his face to the front or rear without facing his neighbors. It provides a better head-rest and less draughts. It effectually prevents the putting of feet on opposite cushions, and makes a seat in which both the back and seat cushions are removable for cleaning.

This seat has just been patented by Geo. W Cushing, of Chicago, Ill.

Side Rods.

Not long ago a fireman was killed on the B. & O. on account of a broken side rod, and, in a claim for damages by his relatives, several good arguments were brought up to show that the company did not use a good or safe rod. There is no doubt that a strap rod would be all right if keyed solid, and the right length at the start—and left alone—but it is their adjustability that makes them unsafe and it possible to change their length. There are a great many locomotives on the B. & O using a draw-strap at both ends of the side rod; this means the shortening of the rod every time it is keyed. We have yet to hear of a solid-ended side rod breaking, they rattle a little, and they ought to, no side rod is safe that is a perfect fit, the boxes must go up and down unevenly and the rod should be loose enough to adapt itself to the changed distances between pins without undue strain. There is altogether too much keying of side rods, where keying is possible. The solid-ended rod prevents all "monkeying" in the shop or on the road, and has been a success from the days of Ross Winan.



The Cheapest Extension Front.

At the Wilkesbarre shops of the Lehigh Valley road they put on a complete extension front for the small sum of $40.

This extension is of cast-iron, half-inch thick, having a flange at the back edge on the inside, on very large boilers the same casting is used by placing the flange on the outside.

The extension is rounded neatly at the front corner, showing no joint, having no bolt heads and requiring no front ring. The door lugs being cast on, all that is necessary is to put this casting on a boring-mill, face the back end and the door joint, and drill the bolt holes in the back flange, or these can be cored in.

The front is about 18 inches long, presents a clean and neat appearance, does not crack as bad as a separate front, and is cheap to apply and replace, as, if broken, there is some return in the shape of iron for the cupola.

This front ought to be a popular one on account of its cheapness for repairs; it is but very little heavier than a wrought front of the same length, and not as heavy as the average one of 24 or 28 inches.

The coal mines under the city of Wilkesbarre, Pa., recently caused a settling that dropped part of the Lehigh Valley machine shops some twenty inches. The walls have been patched up, and are now safe, but they look a little "offish."

Some Notes on Australian Railways

Henry George has been writing some interesting letters from Australia to the *Standard*, of this city, from one of which we clip the following interesting facts:

The Australian colonies are separated from each other, not merely by tariffs. They also have the additional protection of differing railway gauges. The New South Wales railways are built on the standard English and American gauge of 4 feet 8½ inches. Queensland, on the north of New South Wales, has adopted the narrow gauge of 3 feet 6 inches; Victoria, on the south of New South Wales, has the Irish gauge of 5 feet 3 inches. The only intercolonial line of unbroken gauge now existing is that between Melbourne and Adelaide, which is 5 feet 3 inches in both colonies. South Australia began to build on this gauge, but afterward (on the score of economy) changed it for the narrow gauge of 3 feet 6 inches, and so, at a short distance from Adelaide, her own lines break gauge, thus necessitating the transshipping of passengers and freight for Broken Hill, and all points at any distance in the interior

On the South Australian railways some twenty-eight different patterns of engines are in use; on the Victorian railways there are, I am told, over fifty different patterns. There is also considerable diversity in New South Wales. The passenger carriages are also of different styles, but generally on the English model, with first and second-class compartments in the same car—the difference between them being in the upholstery. They charge twice as much for traveling in the first class as in the second class The roadways are well and substantially built—so substantially as to be needlessly expensive, an American might sometimes think. But whether because the carriages are lighter or because their springs are not so good, one feels the motion more, it seems to me, than is usual on the American roads.

The sleeping cars on the New South Wales lines are of the very earliest Pullman model—long out of use in the United States—so long, in fact, that I have never seen anything of the kind there The first sleeping car I entered in New South Wales, which was at night time, seemed to me a rather grotesque and forlorn parody on the sleeping car as we know it. And this impression was heightened when I found that to get a drink of water one must go, not to an ice filled refrigerator, but to a water bag carried on the rail on the platform of the car But these sleepers are really better than they at first look, and one can travel very comfortably in them. The charge for the night is 12s 6d, for a low berth and 10s, for an upper berth.

The particular interest which these Australian railways have for me is that they are all public property and are all built, maintained and managed on public account by public officials. The subject is such an interesting one that I hope to have an opportunity to speak of it more at length hereafter but this is certain—that the State management of railways is, in Australia at least, such a success that no one seems to dream of resorting to the system of corporate management.

Enlargement of Baldwins.

The Baldwin Locomotive Works at Philadelphia are the largest in the world, but are going to be much larger.

The old erecting shops on Broad street, south of the present office, will give place to a new shop of modern design with "saw-tooth" skylights, and two traveling cranes, each capable of lifting 100 tons, and will extend almost to Fifteenth street, having a frontage on Broad street of 158 feet and on Buttonwood street of 306 feet.

Adjoining the erecting shop a four-story machine shop will be built, running from Buttonwood to Spring Garden streets, a distance of 208 feet, and from Fifteenth street to the new office building, 227 feet.

The office at the southwest corner of Broad and Spring Garden will be extended 47 feet, making the total dimensions 167 feet.

In order to make these improvements it will be necessary to remove seventy-five houses, destroy two courts running off Spring Garden street, one on Fifteenth and another on Buttonwood street The works are crowded with orders.

The office of John W Cloud, secretary of the Master Car Builders Association, has been moved from Buffalo, N. Y., to 974 Rookery Building, Chicago, Ill.

Haberkorn's Air-brake Governor and Triple Valve.

The accompanying engravings represent a car governor and a triple valve, devised by Mr. T. H. Haberkorn, lately master mechanic of the Fort Wayne, Cincinnati & Louisville road.

Mr. Haberkorn started in some years ago to supply the passenger equipment of his road with some kind of a brake that would interchange with the Westinghouse, and thus admit of other roads handling their cars into Cincinnati, the company being, or claiming to be, too poverty-stricken to buy the Westinghouse brake.

His experiments led him to supply a complete automatic air-brake equipment that was satisfactory, and which is still in use on the road. His air-pump has the reversing rods outside, and is not unlike the Westinghouse in appearance, doing the same work in the same way. His engineer's valve is a 3-way cock, but having graduating ports, and arranged to work the driving brake with straight air, and either independent of, or in connection with the train brake. We hope to show up all these devices in good time, however.

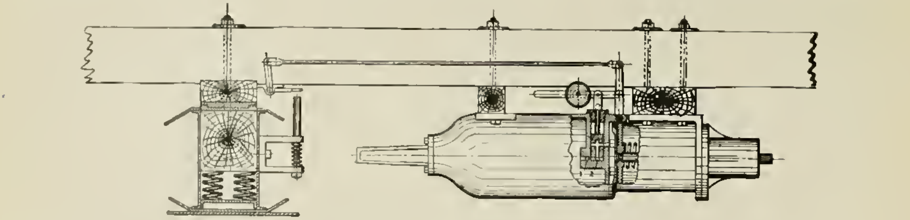
The most interesting and important invention of Mr. Haberkorn is his automatic car governor—which is applicable to any other automatic air-brake. This device is shown as applied to the combined drum and cylinder of his brake—it is really in the pipe connecting the drum and the cylinder.

This governor brakes the car according to its load—the true principle—and prevents the sliding of wheels on empty cars—an object long sought, but generally in the shape of additions to the triple valve, or in safety valves, very wasteful of air. The valve is simply a straight plug fitted nicely into a hole, and carrying at the groove near the top a scarfed, leather packing ring that is set out by the air pressure under it, and entering from the hollow stem; the plug has a hole drilled from the bottom, and a cross-hole that allows air to pass from the auxiliary drum through the plug to the brake cylinder, as shown by the ports; when the pressure of air from the drum is admitted, through the plug, to the cylinder, it soon equalizes, and the pressure under the plug tends to raise it, and will do so unless it is held down; if it raises, the cross-hole in the plug passes the feed port to the cylinder and shuts off the supply of air—no matter how much the triple valve may be offering to the brake cylinder.

The governor valve is held down by a weighted bell crank, as shown, the weight being adjustable by a set-screw in the side of the ball. The valve has no seat and does not bottom at all, but rests on top of its case upon the shoulder of the forked connection to the bell crank.

Suppose, now, you take an empty car and find that you want to brake 70 per cent. of its weight in order to do the most efficient braking and be in no danger of skidding wheels, and you find that, say, 20 pounds is the maximum pressure you want. You set the weight so that the valve will raise at 20 pounds, and that car will not be overbraked in service, and requires no farther attention. But when this car is loaded, it is not only desirable, but necessary to apply more braking force, and, consequently, more pressure. This is done by use of the bell cranks and levers shown, which simply hold down the safety valve. The short arm of the governing valve bell crank is connected by a rod to a second bell crank, located on a shaft attached to the sills of the car over the truck. This shaft also carries an arm, so set that in being depressed it will strike a pin located on the truck frame proper. Now, when a load is put upon the car the springs of the truck are depressed, and the arm of the bell crank shaft will strike the projecting pin on the transom of the truck, and will cause a pull on the rod, and thus the holding down of the governor valve and the admission of more air to the cylinder.

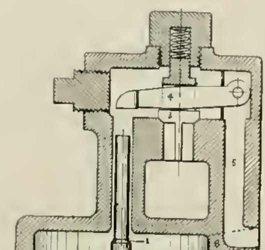
The plug valve is filed off slightly just below the cross hole that admits of a slight leak of air to the cylinder when the valve is not held down solidly, and which slightly increases the pressure when only a partial load is on the car. The spring on the pin in the lug on truck transom is quite stiff, and only operates when the car is overloaded, and by compressing prevents breakage to the bell cranks and rod.



AIR-BRAKE GOVERNOR.

This governor has been in actual use, and seems to do its work well, admitting of the application of the brakes on a loaded car to the full capacity, but effectually preventing the overbraking of empty cars.

There are enough flat wheels scrapped on every road in the country each year, from the sliding of wheels on empty cars, to put this device on them twice over. There are no packed or ground joints, and nothing to wear out. The port marked 1 is the supply port from drum, and 2 leads to cylinder through the governor valve.



TRIPLE VALVE.

Mr. Haberkorn's triple valve is a very simple one, as shown by the engraving, it has very few pieces, no sliding valves, and no packing rings. The valve case is about half the size of the Westinghouse; the main valve is a plain, winged valve, with a graduating spindle on top; it slides nicely in the case without packing. The train pipe connection is under the valve, which sets vertical, and forces it up; in doing so it passes the feed slot 7, and the air, passing around it, flows into the auxiliary drum through the port shown in dotted lines and marked 6; this port and the port to the cylinder are side and side on the flat side of the valve case to the right, and when bolted to the side of the auxiliary drum, cover the ports marked 1 and 2 in the cut of governor. While the valve remains in this position the valve 2 is against the seat above the valve, preventing any air from going above it, and the extension of the stem lifts the end of the lever 4, and thus the valve 3 that opens free communication between the brake cylinder, the port 5 and the atmosphere, through the large port.

Now if the pressure below the large valve be reduced slightly it will move down, closing the feed port 7 and the exhaust valve 3, and admitting air from above the valve and in the drum to flow around the graduating stem, and through the port 5 into the brake cylinder. when the pressure above becomes slightly less the valve will move up until it meets the resistance of the spring above the exhaust valve, which is reinforced by the pressure upon the exhaust valve itself, closing the feed port, and holding the pressure on. When emergency is applied, and a very heavy reduction made in train pipe, the large valve travels clear down, withdrawing the graduating plug 1 entirely from the feed port, and admitting the full pressure of air to the cylinder at once.

This valve has very little friction, moves easily, and is simple; it has been doing satisfactory service for some years, both alone and mixed with other air-brake cars.

The Haberkorn Air-brake Co., Ft. Wayne, Ind., are the builders, and have twenty-five sets of their brakes set up and at work in their shop, that seem to fill all the requirements of automatic air-brakes.

The Grand Lodge of the Brotherhood of Locomotive Firemen will convene in biennial session, on the 10th day of September, in the city of San Francisco. The 400 delegates to this convention will be well received on the coast; western people take to organizations. The firemen are composed principally of young, vigorous men, and their Grand Lodge has the reputation of being the finest looking body of men that meet in convention. Lieut-Gov. Robinson, of Canada, said at Toronto, that they eclipsed in personal appearance the picked troops in the British army. Before federation was consummated it was deemed advisable to change the name of the order, so as to include all enginemen in the title, and there is little doubt that it would have been carried out at this convention. It is not considered essential now, and the scheme will probably not be pushed.

The Engineers' Brotherhood will meet in October in the city of Pittsburgh, Pa. A very large attendance can be counted on, and when it comes to discussing the federation or no federation question, things may be warm and interesting.

The new "class P." 8 wheeled passenger engines on the P. R. R. have wider cabs. On the last lot they had to pick out their thin men to sit beside that Belpaire fire-box.

When you write for publication, always write on one side of the paper, and sign your own name; if you do not want it published, just put it under your *nom de plume*.

Correspondence

The Boyden Air-brake.

Editor The Locomotive Engineer:

In looking over your Number 7, issued for July, 1890, on page 122 I note, under the head of Boyden Air-brake, on the last line of the article, you state "It is in use on the B. & O." I would be obliged to you if you would correct the same, as this brake is not in use on the B & O., except on four cars, on which the application is entirely experimental.

Respectfully, G. B. HAZLEHURST,
Acting General Supt. M. P.

Baltimore, Md.

[The editor has been given to understand that the brake was in use as stated, and with this idea repeats the assertion in the July issue. When we are misinformed we are glad to know it.]

Radical Cure for Lubricators that "Feed Across."

Editor The Locomotive Engineer:

I am an old Mossback. I do not believe in cylinder oil, I like good old tallow; I do not believe in the sight-feed lubricators; steam when kept good and dry is the best lubricator that can be used, put a little tallow in cylinders when you shut off, going down hill.

If "New England" tallowed his cylinders from the cab he would not have had any trouble as he describes.

Let us hear from everybody on sight feeds and cylinder oil.

Texaline, Tex. "OLD MOSSBACK"

Big Engine—Slipping—Vacuum—Brakes—Electricity.

Editor The Locomotive Engineer:

In reading the June number of THE LOCOMOTIVE ENGINEER, I see where W. E. Andros, on page 108, says that big engines have no tendency of doing the engineers up; will he please give us a little more explanation of what he means, and I will show him how big engines have done us up, and done us up badly, too.

I read so much in your paper about engines slipping with steam shut off. I never had any to slip as I read it, but I had them to lock and slide on a bad rail for ten or fifteen feet, until the train would bump the engine, and then the wheels would revolve as nice as could be; this was on a grade of only sixty feet to the mile. I know how the vacuum brake works; will some one please tell me how the automatic vacuum brake works, and also did any one ever experience any electricity about an engine while it was blowing off steam?

Baltimore, Md. OLD TIMER.

On the Care of Cab Brass.

Editor The Locomotive Engineer:

I notice in nearly every issue of your valuable paper some fireman giving receipts for polishing and scouring brass, blacking boiler heads and front ends, scrubbing cabs, etc.

I would like to give these firemen a receipt that we have down in this part of the country, and that is, don't scour at all; black all the brass, keep engine wiped clean, and she will make the time just the same.

We have large engines, weighing from forty-five to sixty-five tons, in both passenger and freight service, and when a fireman has stoked away from five to eight tons in 130 or 140 miles on passenger, and from ten to fifteen tons on freight, we think he has earned his money.

I would like to hear from some one who has a receipt for a black paint or varnish that can be applied to cold brass and will not blister or scale off.

We have all found from experience that hot brass can be turned a jet black by applying a little signal oil and water occasionally. Let us hear of some way by which railroad officials can be prevailed on to abolish this everlasting scouring and scrubbing.

Mattoon, Ill. FIREMAN

The Mystery Solved at Last.

Editor The Locomotive Engineer:

Engine 170, a Roger, consolidation, 20x24, weight 110,000 pounds, on the Henderson division, L. & N., used to slip, without steam, when going down hill. As engines are run "chain-gang," most every man here has run her and had the same or similar experience. She would slip on a dry rail but was worse on a wet one.

One's first thought was a broken equalizer or spring, or that side rods had gone. Some thought she was about to strip herself and would get back on the tank. Sand would generally stop it.

She never did this until she had been overhauled, and the foreman said her left main tire was left ⅛ of an inch larger than the others—by mistake—and was positive that caused the trouble.

I have known this difference in size of tire to exist on other engines and they didn't slip.

Now if that was the cause why didn't she slip on every down grade?

She would sometimes make a round trip and behave all right and again she would have several "fits" in a day or night.

Fritz, our favorite German machinist, and a good one, said it was because she was turned out on Friday. H. DIV

Nashville, Tenn.

Is It Caused by the Side Rods?

Editor The Locomotive Engineer:

I have just been reading W. F. Relyea's account of engine slipping without using steam, and would like to inquire of him if the engine slipped before solid rods were put on her, and what the difference in weight, if any, is between new and old rods?

Have also read Wm. Bosley's account of same trouble, where it was caused by counterbalance being too heavy.

It has occurred to me, after reading both articles, that the solid rods on the engine Mr. Relyea mentions may be heavier than the ones that were originally made for her, and would work in the same manner as an excessive counterbalance. Am I right or wrong? WM. P. ARNOLD

Chicago, Ill.

[There would be little difference in weight of solid and loose strap rods. Mr. Relyea's idea is, that slipping is caused by excessive or uneven counterbalance, such as would be caused by a twisted axle; the particular point he made was that the engine slipped while being towed in with her main rods down.]

The Most Reasonable Explanation of Cause of Slip When Shut Off.

Editor The Locomotive Engineer.

Though the reports which have appeared in your columns lately of engines slipping ahead while running down hill without steam savor a little of the uncanny in railroading, yet I offer the following suggestion of a possible cause, which can be worked out in cold figures by any one having the time.

Your correspondent, Wm. Bosley, stated in your last issue that his 17" 8-wheeled Brooks engine slipped badly going down hill at 45 miles per hour, after receiving a new main wheel which had an excessive counterweight, and also that this slipping ceased entirely when the excess of counterweight was removed. This statement is close enough for my hypothesis.

"Nosing," as it is sometimes called—the side swinging motion so familiar in the cab—is due to a horizontal couple produced by the joint action of counterweights and reciprocating parts tending to turn the whole engine about a vertical axis passing through its center of gravity, and is all transmitted from the wheels and axles by a greater or less forward and back motion of the driving-boxes. In a case of excessive counterweight in one wheel on an axle both ends of the axle will travel forward and back, relatively to the engine, very rapidly at 45 miles an hour.

When a driving-wheel is over-counterweighted, its rotation about its center is exactly on the same plan as the whirling of a ball about a center to which it is attached by a string, as the center of gravity of the wheel is not at its center of rotation. Now take a ball or chestnut tied to a string and whirl it as in boyhood and notice that, if you reproduce the horizontal back and forward motion I have mentioned, the ball can be rotated at great speed. Each counterweight in a pair of driving-wheels produces this motion for the wheel at the other end of its axle—and I think the testimony goes to show that the energy developed is sufficient to skid the wheels. As I say, it can be calculated. Of course this energy is supplied by the train shoving the engine down hill, and its expenditure can be shown to act as a brake on the train. Set some brakes on your train and see if slipping does not cease.

Mr. Bosley also said that pulling reverse lever to center stopped slipping—when lever is in this position lap keeps both ports closed, and in a balanced valve very little steam or air can pass into steam chest past edges of valve. In this condition air is drawn through cylinder cocks in quantity, and, as it cannot escape, soon both pistons are working against heavy back-pressure, such that the wonder would be if wheels were not locked to slide without turning. E. H. MUMFORD.

Detroit, Mich.

A New Way to Rate Loads for Fly Runs.

Editor The Locomotive Engineer:

Hearing a conductor bragging about a "fly run" he made with a ten special, calling it a "picnic," I asked the engineer about it—not supposing, of course, that he helped to make the "picnic" run; he said:

"It was a pretty good run, and I guess it was a picnic for the conductor—the fireboy found him asleep in the doghouse at Arena. The 'picnic' I had was not so easy. The last trip in, I asked the boss for some extra tender brasses; and just about that time Jim, the car repairer, came along, and told the boss that all the hand cars used one kind of brasses, and that just mixed the thing up, so what did he do but throw on a lot of old Roger brasses that wouldn't fit the 218—as she has no M. C. B standard axles, and, to make things worse, that new man in the office got an idea that in giving a 'special' orders, it must be a mile for each car, we had forty loads, and the dogon fool gave us a forty mile order, I just had to fan them, and the first thing I knew, one of the tender-boxes got hot, and the fun commenced. Every stop we made, the fireman would have to oil around, while I poked dope and dirty waste in that tender box, for I couldn't get one of them brasses in, and that is just the way we had to monkey along all night to get over the road."

I wonder if that dispatcher won't get a patent on that new load and speed chart of his.

Fly runs are generally made on the tail end of the train, but let a poor run be made on account of hot boxes, poor dispatchers or any other cause, and it's the engineer—but I guess most of the boys have been there. W. DE SANNO.

Corry, Pa.

Not a Hero.

Editor The Locomotive Engineer:

Noticing in your June issue an article under the heading, "Don't Take the Risk," I would like to give you my experience. On March 7, 1888, I was pulling passenger on the Cincinnati Southern, between Oakdale and Chattanooga. I was running about 45 miles per hour, when, just before I struck the switch at Lorraine, Tenn., I noticed the switch rail point, which was a spring connection, sticking out about *a mile*, it looked to me. I barely had time to slap on my air and made a break for the gangway, but before I reached it she turned on her side with the tank, baggage car and two coaches on top of her. The last thing I remember was seeing the ground going past pretty fast, about one inch from my nose. I got a great send-off in the daily papers for "sticking to my post," and saving the lives of a hundred passengers. There were only seven passengers on the train—a pumper, traveling engineer, one passenger agent, one supervisor, and three section men, and if the parties who wrote me up in the paper had seen me hustling to get off, they would never write up another engineer who "stuck to his post" and "risked his life to save his passengers." I would rather be a live coward than a dead hero. BOB M.

Colorado City, Col.

Which Way do They Slip?

Editor The Locomotive Engineer:

I have been taking your paper about two years, and take great interest in some arguments found therein. In these arguments a man finds food for thought, that otherwise he would never, probably, have thought of at all. In several issues past I have noted opinions of different persons as to cause of engines slipping while running down hill. *If* such is the case, why is it? I would like to ask one question of these men who claim that one thing or another causes it. I have been trying to get it into my thick head which way they mean the word "slipping" to be construed—wheels revolving faster than speed of engine calls for, or, so to speak, nearly stopping or entirely so? In my opinion the slipping of drivers *ahead* is in such direct opposition to natural laws as not to apply to this case, probably I may be quite mistaken as to their meaning

Reading, Pa E A G

[It is claimed that the engines mentioned slip their drivers *ahead*, while running shut off—just as they would if steam was used.]

Some Observations on Bad Steaming Engines.

Editor The Locomotive Engineer.

I have been firing several years, and, like all other men of my calling, my greatest dread was a "bad steamer." I was on several of them, but always with the same engineer, and guess I never would have struck a free steamer if Ben hadn't gone away to get married, and I got onto the extra list. I suddenly found good steamers—even some of the hard old pills I had hated before.

Then I began to inquire into the "cause why," and to observe I soon found that the way water was supplied to the boiler had almost as much influence on the steam gauge as the way coal was supplied.

I found that the men who were "even pumpers," who kept the water at about the proper level, supplied it evenly, increasing the feed for heavier work, and decreasing it for lighter work, generally ran good steaming locomotives.

I also found that the men who slap on the squirt full head on starting out, and shut it off when they have three gauges in the stack, have poor steamers.

I pray for the former and play for the latter—pray that I go out with the one, and play I am sick when marked up to worry with the other.

Philadelphia, Pa. B B. B.

Some Facts About the "Neversink" and Another Early Locomotive that Exploded.

Editor The Locomotive Engineer:

The enclosed letter will explain itself. It goes to confirm my statements, leaving the cast-iron stay bars unsettled. The Dr. Lardner referred to was charged at that time in the newspapers with not confining himself strictly to scientific affairs, and possibly was in error as to the cause of the explosion. J Bourne.

Newton, Kas

JOHN BOURNE Dear Sir: Having read some articles by you in the May number of that most excellent paper, THE LOCOMOTIVE ENGINEER, to which I am a subscriber, I write to state that you are correct as to the explosion of the "Neversink."

That engine was an 8-wheeled combined, built by Baldwin for the P. & R., and it exploded Thursday, Jan. 14, 1847, near Mill Creek Bridge a short distance above Manayunk. The *Railroad Journal* for January, 1847, contains a full account of the accident.

Regarding the explosion of the Norris engine to which you refer, the engine was named "Richmond," was one of a pair built for the P. & R by Norris Bros., Phila., 1844, and exploded near Reading, September 2d, 1844, killing engineer, two firemen and the conductor.

This explosion occurred during a violent thunder storm and was supposed to have resulted from the engine having been struck by lightning

It was investigated by a celebrated engineer and scientist, Dr. Dion Lardner, commissioned by Norris Bros., and I have before me an elaborate copy of his report. It was most satisfactorily proved that the engine was well built and that the cast-iron stay bars (although a faulty plan of construction) had nothing to do with the accident. The boiler iron was subjected to tests and found A1, pumps worked perfectly, and the engine drew easily 700 gross tons, a large load for such an engine, having cylinders 14½ x 20, drivers 46", and weighing but 36,925 with wood and water The mate was the "Atlantic" I write this thinking it may be of interest, and hope to have Mr. Hill publish the full account of it.

Chestnut Hill, Pa. HENRY L. NORRIS, JR.

How a Train Runs Down Hill.

Editor The Locomotive Engineer:

I notice an article in your July number, signed J. H. Burrell, Jr., in which he states that the tendency of the locomotive on a down grade is to run away from the train, and that the train holding her back is the cause of the slipping of the drivers after steam is shut off

I well remember of an instance of a freight train running away on the Jamestown road between Dayton and Gowanda. I think the distance is eight miles, and the grade 132 feet to the mile. Engineer Walter Russell was running the engine, and the speed was so great that it was with difficulty that he could keep his feet or hang on, and he stated at the time that the engine was running about as fast as it seemed possible to run, but every few seconds the train would give the engine a push which increased her speed.

I think there is a good deal of imagination in regard to the engine slipping after steam is shut off. I ran an engine over twenty-five years, and can say that I never remember or knew of my engine slipping her drivers after the throttle was shut off and the steam had left the cylinders, unless she was reversed.

Any engineer will tell you that, especially on freight trains, after shutting off steam they can feel the engine fall back on the train, and the buffers will always come together on a heavy down grade.

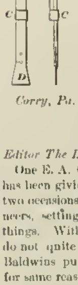
W. H. H. WEBSTER.

Chatham, Ont. U. S Consul.

Making an Engine Steam with a T-Square.

Editor The Locomotive Engineer:

Enclosed please find sketch of jig for setting exhaust nozzles; and in nine cases out of ten where crooked nozzles prevent an engine from steaming this jig will remedy the trouble. Take two pieces of pine 1¼x¼, and of proper length, put bands around making a slip joint tight enough to stay where put; in lower end put in sheet brass fish tail *D*, square with the center line of gauge. Clean off top of nozzle, set gauge on central, and see how the point ranges with center of cone, fore and aft and across, if it does not range central face off bottom joint of nozzle (not exhaust pipe) until it is right. For double nozzles the gauge must be used right and left, and it will make a straight shot every time. It is not patented



Corry, Pa. W. DE SANNO.

On the Old Subject.

Editor The Locomotive Engineer:

One E. A. Campbell, Supt. M P. and Machinery, has been giving his opinions quite freely on one or two occasions recently in regard to traveling engineers, setting of valves, lost motion and other things. With all due respect to Mr. Campbell, I do not quite agree with him when he states that Baldwins put hammer-fit bolts in eccentric blades for same reason that eccentrics are keyed on shaft, viz., to keep meddlesome engineers from monkeying with those things. Eccentrics are keyed on shaft, and hammer-fit bolts are put in eccentric blades to keep them secure in place in service. Mr. Campbell does not have much faith in the ability of locomotive engineers, it seems; I wonder what he pays his engineers per day.

I would like to be "sitting on a hill," and behold one of the little mogul type 11" by 16 hauling thirty-five loaded, 50,000 pounds capacity cars. I just imagine that he would need to give her more "lost motion" in the shape of another "little mogul." She might sound square through after the ten-minute racket. When I see engineers and firemen sitting about roundhouse telling about fast runs and great steamers, I have some suspicion that such men are a leetle disappointing when out on the road, this often applies to others besides engineers and firemen. From ten years' experience running a locomotive, I am in favor of a good, reliable traveling engineer; one that understands his business thoroughly will save thousands of dollars to a railroad company yearly, while the sort of man that some roads employ will never save anything. I am not in favor of lost motion in valve motion or running gear of locomotives.

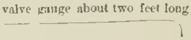
Pittsburgh, Pa. J. J. CLAIR.

Explaining an Explanation.

Editor The Locomotive Engineer:

I suppose I will have to be a little more explicit on my ten-minute racket of valve setting for the benefit of our friend Mr. C. F. Richmond, as I feel a little aggrieved that he should think that I would deviate from the truth when I am penning these articles for the benefit of my fellow-men and not for a financial consideration. I will tell it in another way, and I think he will catch on, and if he does not, just tell him to call on me if he is a subscriber for this paper. I will take pains to show him that I am perfectly truthful in my statement.

Take a valve gauge about two feet long like this



Gauge your valve with it, make center-punch mark on your steam chests, base or any part of cylinder that is stationary, then gauge your valve stem back of knuckle, if rod has one. Any way, gauge the length of gauge; in this way you only have one tram or gauge to handle; then take your wheel centers from main rod as it rises and falls with uneven track, but every time after main rod is run you always have to take center over; now in this way you only have to take centers on one side and use travel on the other. Now, Mr. Richmond, do you catch on? You misconstrue my meaning about using liners on shoes; if you do this you have to alter parallel rods, and all this is more trouble than chipping out holes in eccentric blades of old engines.

You are off on the inclined engines; you get the length of valve rod the same as straight cylinders; if not you could not throw her out of gear.

I simply told you as regards to gauging valves to take off steam chest cover, to prove my assertion in case you doubt it. E. A CAMPBELL,

Houston, Tex. Supt. M P & Mach'y

Speed of Heavy vs. Light Trains.

Editor The Locomotive Engineer:

In your July issue you say that Mr. Burrell, Jr., "is wrong in presuming that a heavy load will run faster on a down grade than a light one."

It seems to me that Mr. Burrell, Jr., is right, and "ye editor" on a wrong tack, for it seems to be shown on all sides, from the boy and his sled to the freight train, that a heavy load will run faster, other conditions being equal, than a light one.

A heavy man on a heavy bicycle coasts away from the "spider" on his "light roadster" every time, and the same seems to hold good in all cases. If there is no difference, why does the D & H. C. Co. grade their gravity tracks so as to give the "empties" a steeper incline than the "loads" to acquire the same speed?

I suppose you will cite the case of the two falling bodies of unequal weight, and you *may* be right, but it doesn't seem so to me, as rolling down and dropping down do not appear to be just the same kind of a dose. O. H RIDGWAY.

Swampville, Pa.

[In a vacuum a light weight and a heavy one of equal size will fall at the same speed. In the air the heavy one will gain slightly on account of the resistance of the air On a railroad grade, a heavy car of exactly the same size of a light one would meet the same resistance from the air, but would have more force to overcome it, which would give it an advantage, but it would lose on account of increased friction due to its load. The reason that a train of light cars will keep up to a heavy locomotive when drifting down hill, is that much of the force of the locomotive is expended in moving the machinery. The friction is much greater on the locomotive than on the cars, weight for weight. The D. & H. Canal Co.'s gravity road has a steeper grade, in some places, for empty cars than for loads, and on this grade cars will run faster. There is no particular attempt to make them travel at a uniform speed with the loads. The loads are *hauled* up the main grade and let run down short inclines to another hoisting plant. The line provided for empty cars is long, and so arranged that the cars return all the way by gravity, and as they arrive at the place of starting their line must be of a less grade than the up line, worked by engines, with *drops* between to gain distance. Men often imagine that a loaded train runs faster than a light one because it takes more force or a longer time to stop them. The braking force must be in proportion to the weight as well as the speed. Of course, when a very high speed is attained, the resistance of the air acts as a brake and tends to slow down the light car more than the heavy one, if their areas are the same.]

A New Fire-door Deflector.

Editor The Locomotive Engineer:

Enclosed sketch shows an improvement made to a P. R. R. "Class O" fire-box door, now being tried on Engine No. 1053 for some time, and showing very good results.

Fig. 1 shows a vertical section of the door closed, Fig. 2 the position of liner when the door is opened, and Fig. 3 the liner itself.

I use the standard casting for fire-door and liner, and hang the liner on two eye-bolt hinges, as shown at *a a*, placed a little above the center, so that it can swing freely. On the top of liner a finger, *b*, extends above, so as to come in contact with ring on fire-box when door is closed.

The door casting has very large opening cut clear across above the center line, to admit of a large volume of air. This is regulated by a suitable slide.

When the door is closed the liner is automatically pushed to the angle shown in Fig 1, and the air passing in through the openings, being deflected upon the fire, is more perfectly mixed with the gases. When the door is opened the liner falls to the same position as in the old style, or common door, and as shown in Fig. 2.

I claim for this arrangement that it will save some little coal, will burn most all the smoke—in fact, has all the benefits found in using the English style of fire-door or deflector, without having any of its faults. J R ALEXANDER

Pittsburgh, Pa.

A General Manager's Idea of the Slip.

Editor The Locomotive Engineer:

From the number and credibility of the engineers who have witnessed the slipping of drivers, it must be conceded that they do slip, improbable as it may appear at first thought.

My explanation of the slipping is that the top of the wheel travels faster than the bottom, and when this extra velocity, combined with the weight of the driver, its counterbalance, rods and pins, overcomes the traction, that it must slip. Speed is all that is necessary to cause it, and they all agree that the slipping occurs only when running fast. Car and wagon wheels, running on the track or ground, are the same as a planet wheel, the bottom virtually being the center, around which the rest of the wheel revolves, the point farthest from the bottom traveling fastest, of course. This theory would slip every wheel in a train, if running fast enough, and it would make the top of a wheel travel 120 miles an hour when the engine was going 60.

ALLEN WOOD,
M. M. St. Augustine & South Beach Ry.
St. Augustine, Fla.

Only True Principle of Signaling.

Since the subject of signals, block or otherwise, has become a living topic among American railroad men, our inventors have gone to work to supply something for the demand.

Devices of all kinds are schemed up, many of them very ingenious ones, but the great majority of them are useless and some actually a source of danger instead of safety.

The great trouble with our signal inventors is that they do not fully realize what a system of signals should do, and mistake *time* for *motion*.

The most popular delusion is the automatic time signal—that class of signals that by clock-work, electricity or the flow of liquids, record the time that has elapsed since a train or engine has passed it—these signals do tell the engineer of the following train just how long it has been since the train ahead has passed the signal, but it fails to tell just what is most necessary to know—is it far enough away to allow the following train to run regardless of it?

The first train may break down and stop in the cut just around the curve, but the time signal may tell the engineer of the following train that it has been gone twenty-five minutes. It is not necessary or desirable to know how long a train has been gone, but it is necessary and desirable to know if the line is clear to the next signal.

No engineer can make extra fast time with comfort or safety when he is constantly expecting to find something in his way. If he knows that the next mile or two miles is clear, he will run at high speed with confidence.

Positive block signals are the only safe ones and the true principle; all others must give way for it in time—because it is the best. Block signals for double track roads are easy to design, construct and operate; a satisfactory and efficient block system for our great, single track lines is not so easy to design, construct or operate, and there is room for invention in that line; but don't go off on any half-way measures—every signal should say to the engineer either, "Line clear" or "Stop."

The positive block has always been a success—all other plans are, so far, in the nature of experiments—many of them disastrous ones.

Two Wabash Kinks.

On some sections of the Wabash road they are troubled with bad water, and all the engines are

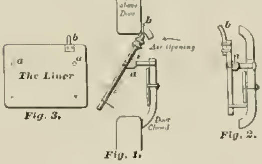


Fig. 3. Fig. 1. Fig. 2.

FIRE-DOOR DEFLECTOR.

rigged to blow out the boiler, if necessary, when running. The blow-off cock is a very large one, designed by Supt. of M P Barnes; it is located under the waist of the boiler between the guides, and opens toward the inside, so that the pressure tends to close it. There are no threads to stick, but the stem is forced in by a system of compound levers, operated by a handle on the running board. There are provisions for blowing out from either side of the engine, but this can only be done by taking off a cap on one pipe, and putting the blow-off pipe on there. This road also used a square, cast-iron whistle that is very efficient; is made in one piece, and has no machine work on it except to thread the stem and cut out two steam slots about four inches long and a thirty-second wide; cost about one-third of a brass whistle as usually made.

What has become of that big locomotive works that was going to be built at Cincinnati, the capacity of which was stated as being "750x500 feet, covering nine acres of ground, with a capacity of a locomotive every nine hours"? Now that the speculation on lots in the neighborhood of the proposed site has died out, we hear no more about the "works." By the way, there was just such a works to be built in Philadelphia last year.

Considerable interest has been manifest in the subject of sight-feed lubricator not delivering the oil to each cylinder in equal quantities, but so far most of those who write simply state that feeding "across" can or cannot occur. All the facts that can be gained from experience will be instructive—let's have them.

Repairing Injectors.

By J. B. RICH.

There may be fields in which the diabolical repairer gets in more effective ruination work than repairing injectors, but I doubt it, the natural tendency is to bore out some hole "so the thing can get a chance to work, these makers are afraid they'll do too much," and, as nature rules here, the tendency is followed.

The first instruction of a code of rules for repairing injectors would be—Don't; but why? is asked. Because the average repair man—*i. e.*, general repairs—though he may understand the working of an injector pretty well, doesn't know the necessary qualifications and proportions that must exist, to do the work properly. If, in connection with the repair shop, there is a brass shop with good facilities, it is not such a foolish undertaking as without, but it seems plain that a place where the parts are made in quantities can turn them out cheaper, and, what is more essential, exact in size and proportion, but many railroad shops are run for the sake of saying, "We do all our own work," apparently regardless of cost, and as these will persist in repairing things they know very little about, a few words may not come amiss. In the first place, note before you take an injector off how it was placed; if you can't remember, mark it. I see lots of men laugh at the idea of not knowing how an injector goes up, but I've seen more than one experienced engineer get them up wrong end to, and they were not drunk or crazy, either—forgot. If you feel it your duty to explore the internal regions of the animal, do it carefully; a crowbar and sledge aren't often needed, and remember how the tubes and parts came out (another smile of incredulity, perhaps), but again let me say I've seen them put in wrong, it will do no harm to note the relative positions of the parts, and may save a bad mistake.

Perhaps the tubes are worn large, as is often the case, some seem to think if they bore them out smooth—no matter how large it makes them—the steam and water will think it's all right, and slide in just the same as before—but they don't. You can rest assured the makers know somewhere near the right size for effective work, almost as well as the repairer, and it might be as well to follow some where near in the old lines as far as sizes go. The distance from tube to tube, also, has some effect, so don't bruise the ends poking them out, and then cut them off smooth, thinking the water won't mind the extra jump; sometimes it does. Remember these things, and if you must tinker—and some have to by company's orders—do it as nearly like the instrument originally was as possible. Sometimes the ball joint or seat of the union gets leaking, and it is necessary to re-seat it. We usually see a ball rose reamer filled with soap or similar substance to prevent "chatter" on the seat. All this is unnecessary, for with a "mill" tool properly cut there need be no chatter. Properly cut don't mean cut with precision in spacing the teeth, just opposite—cut hap-hazard, without regularity at all; pay no attention to spacing, but make the teeth as uneven as possible, and you'll have a smooth cutting tool, the principle is the same as in the file—what ailed the first machine-cut files was, they were too regular—spaced evenly, and they chattered badly; they've changed now. So it is with reamers and the like, more particularly "face reamers," as for ball joints in unions.

If some of the writers on locomotive valve motion, size of ports, back pressure caused by use of link, etc., would stop to think that while a well-designed link motion will give from 10 to 14 square inches of opening for the exhaust at the end of the stroke, the steam has to force itself through a nozzle of only five or six square inches area, it would ofttimes change the color of the alleged faults.

While most of the States have laws, more or less bad, governing the size of openings, etc., in smoke-stack and front end spark arresters, little if any attention has been paid to the fires caused from faulty construction or careless use of ash-pan slides and dampers. More fires are caused by the latter than by the former.

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CONTENTS.

A Committee of Safety.

Grievance committees of labor organizations, especially railroad organizations, are formed as a sort of legislative committee to look after the interests of the whole body, especially in the matter of the dealings of the order with the company. The duties they are designed to perform are necessary, perhaps, and certainly time-saving and economical to the body; but the duties they often do not perform cause endless trouble and turmoil.

The protection of individual members from wrong and injustice is laudable and right, and cannot be carried too far where justice is given to others as well as demanded for the members.

There seems to be a great unworked field open to the orders in protecting the members and in providing for the widows and orphans of men who meet their deaths on the road. We refer to the power of the organizations to collect data concerning the condition of the road and its appliances on which they are employed, to be used as evidence where members are prosecuted for manslaughter, when accidents occur for the want of proper safeguards. How often it happens that when a man is killed the blame of the accident is laid at his door, and a cheap settlement is made with his family on the basis of his being to blame. Evidence to refute these charges, in the hands of a good committee, would prevent the cheating of widows and orphans, and lighten the load of sorrow on their minds in clearing the name of the victim of some open draw without a signal, or break-in-two, where no automatic brake was in use.

Suppose the grievance committee of every lodge of engineers and firemen in the land would prepare a certified statement of the condition of each division of every road on which its members ran, stating the present conditions of signals, switches, track, bridges, etc., the engines and cars, and state what modern appliances for safety were needed and wanting.

With it well known that this committee had such facts and figures at its finger ends, and would present them before any court, or in any press, to defend its members from wrong, there are few railroad officers who would dare to constitute themselves judge, jury and executioner, to condemn men as they do now.

If a bad system of train dispatching was practiced, how easy to collect evidence and demand a reform.

Is there a low bridge or a dangerous obstruction on the road? What would be the result if the superintendent were informed by an authorized committee of its existence and danger, and that the order or orders would hold the road responsible in case of accident to employes? The obstruction would be removed, or other means employed to avoid accident from the cause stated.

With such data in the hands of the men, railroad commissions could easily find dangerous practices and appliances, and demand reforms on lines in the right direction. Such data would not hurt honest managements who were really trying to furnish the best service possible, and it would prevent a lot of injustice and oppression now borne by employes.

Then, if the committee could go a little further, and report to the lodge, or the officials of the road, for punishment, all men who knowingly disobeyed rules of safety—these fellows who won't stop at grade crossings and drawbridges, who cut off and run for water, leaving the train to follow, the men who neglect to whistle for road crossings, forget to look at the bulletin board, don't examine their engines at the end of runs, and test the brake when they want to stop first, instead of before they leave terminals. We need men who look out for these things just as bad as we need signals, safety switches, brakes or protected draws, and just as bad as the trainmen need automatic couplers.

What would be the matter with a "committee of safety," who would hunt for every fault that threatened the safety of train and enginemen, and their passengers, and demanded a remedy for that fault, be it what it may, and counting the faults of the men just as dangerous and as badly in need of reform as the faults of the management? Would not such a plan be of equal benefit to the men, the company and the public?

The Commission Fever.

The arrest of ex-purchasing agent McKibben, of the Union Pacific, for doing too heavy a commission business, created only a nine days' wonder to the public, but his case has made many a railroad man wish that he "wasn't in it." Mr. McKibben, it seems, if the reports are true, was not fair with his company—it's a mighty mean purchasing agent who wants more than a 50 per cent. commission.

When a man, railroad employe or otherwise, puts himself to trouble and pains to introduce another's goods, it is but fair that he be paid for his services, but when a railroad puts the power to purchase supplies into the hands of a man because of his knowledge of prevailing prices, etc., and pays him a liberal salary, of, say, $10,000 per year, he ought certainly to do his best to buy goods as reasonably as possible, and not demand more personal profit than the original producer, and all the intermediate dealers combined.

It is not only the purchasing agents that have a finger in the pie; the commission itch is contagious, and has been known to affect all hands, up to the president. It has come to the point where dealers are plainly told that "*cheapness* is a secondary consideration; charge enough to pay about three commissions."

The "commission" fever is at its height just now—same as the Canadian fever among bank men—and will soon be declared epidemic by convening councils of stockholders—then there will be a quarantine and—reform (?)

The stockholders of American railroads pay about as much attention to the property they own as a sea turtle to her family; the turtle lays her eggs in the sand and goes off on her vacation, expecting to find a half grown family of turtles when she gets back—and is mad if she don't—the stockholders buy the stock, put the property in charge of a manager, and demand *dividends*. Let the motive power department keep the rolling stock up on as small a per cent. of the earnings as possible, or let it go down; the freight and passenger agent cut rates, the purchasing department collect toll for doing its work; put in stone ballast or cut wages and shorten hours—no matter, so long as a dividend is paid.

Maybe, sometime, railroad stockholders will keep an eye on the way their property is handled—just as they would if they bought a store or other private business.

Wanted, "Company Men."

We recently heard a young motive power officer express the wish that he belonged to a certain "gang,"—thought it would be worth considerable money to him.

He did not refer to any order or society, but to one of the organized bodies of supply dealers, who do business by processes now well known, but that are not always considered perfectly "straight." To all the young master mechanics who have an ambition to rise in their profession, and the older ones, too, for that matter, we want to say that the safest and best plan is not to belong to any "gang."

Be known at home and abroad as "a company man"—the railroad company's man. Put your best energies into your work, do the best you can for the company you serve, and let others do all the scheming, take all the bets, and drink all the wine. You will sleep well, eat regular, and stay as long as you want to, and go up higher when there is a chance. Keep on good terms with your men, and try to have among them the name of being just—remedy a wrong for them, just as quick as you do for the company. Don't be afraid of being called a "company man." If there is one thing above another that the railroads of America need in their motive power departments to-day, it is "company men."

The Regular Juggernaut.

A dispatch from Sycamore, Ill., dated July 23, says that a mail train ran into an open switch, collided with a freight train, killing a fireman, and adds, "The cause of the wreck and damage have not been ascertained." It looks to a man up a tree as if the cause was very easily explained; criminal carelessness and inadequate appliances had a good deal to do with it.

Every switch ought to operate a signal from the rails themselves, that would give the approaching engineer time to stop before reaching it if it was set wrong, this for single track lines. On double tracks no switch should have a facing point, then there would be no switches to run into. First-class roads are so protected. It would be a big improvement on some of those roads in the Middle States, if they would pay living wages to real, live trainmen. These two-for-ten-cent, make-believe brakemen don't know enough to shut a switch after a train has gone into it Ten enginemen have lost their lives since the first of July through this very class of accidents.

Promotions.

Judd Barnes, engineer, has been promoted to the position of traveling engineer of the Mountain divisions of the Denver & Rio Grande road, vice W. D. Lee, resigned to go into private business. Both these men were first-class engineers—as high a compliment as we can give any railroad man. The writer of this had the pleasure of doing considerable railroading "along of" both men in the early days of the Rio Grande's mountain climbing.

A E. Welby, formerly chief clerk to the General Supt of the Rio Grande Western road, has been promoted, and now fills the chair of his late chief.

Mr. William H. Owens, who has been for some years general foreman of the Richmond & Danville shops at Manchester, Va, has been appointed master mechanic of the Georgia Pacific, with headquarters at Birmingham. Mr Owens is one of the thinking young men who will make his mark.

Books Received.

THE OFFICIAL RAILWAY LIST FOR 1890 Being a tabulated list of all the operating officers of Railroads in North America Edited by Walter D Crossman. Published by the Railway Purchasing Agent Co. The Rookery, Chicago Price $1.00.

This list is the most complete, and in the most compact form of any published, and seems to have been carefully edited. It contains cuts of a number of the M C. B standards and other information of interest, together with a very large amount of advertising The chief value of the book is its official list, and is the best to buy, as it gives in condensed form, beside the names and addresses of officials, the length of road, gauge of track, number of locomotives and freight and passenger cars in service.

SPON'S ENGINEERS' AND CONTRACTORS' DIARY AND REFERENCE BOOK FOR 1890. Being a large blank diary book for use of contractors in machinery or on other engineering work, containing also numerous valuable tables, the recent reports of English engineering societies, and other information. E & F. N Spon, 125 Strand, London, Eng., and 12 Cortlandt st, New York. Price 50 cents

This is a large bound book of 200 pages, and would no doubt be of especial interest and value to contractors doing engineering work in the English colonies, and away from the home markets, as pretty nearly everything of an engineering nature is advertised in the book. It is much cheaper than any blank diary of the same size could be furnished.

PRACTICAL SANITARY AND ECONOMIC COOKING, ADAPTED TO PERSONS OF MODERATE AND SMALL MEANS By Mrs. Mary Hinman Abel. Published by the American Public Health Association. P. O. Drawer 289, Rochester. N. Y

This little work is one of the well-known "Lomb Prize Essays," and is issued by the American Public Health Association at actual cost, Mr Henry Lomb, of Rochester, N Y, giving the author a prize of $500. The inscription of the book is, "The Five Food Principles, illustrated by Practical Receipts"

The author starts out and explains, in an entertaining way, the principles of preparing food; assuming that the housewife has only the commonest utensils and moderate means, she "gets right into the flour," and really gives something practical, new and valuable. The author attacks and exposes some of the wrong impressions about food, and gives sensible and plain instructions in the economical and healthful handling of home kitchens. She shows how to make the most out of a little, and do it well, and her work has the advantage of having been critically examined and endorsed by a board of scientists that make a study of sanitary and hygienic systems and methods

There are numberless receipts, sample bills of fare for different seasons of the year, and a few sample menus for cold lunches that ought to be of interest to those who prepare and those who devour dinner-pail meals—and most of our readers know what that means.

The book is entirely new and clothed in new garments—it is nothing like your old cook book at home—it has nearly 200 pages, and is well worth the price asked, 40 cents bound, 35 in paper covers.

ASKED & ANSWERED.

(47) E. A. G., Philadelphia, asks:

An engine is square in the corner, but hooked up two or three notches is lame. Where is the trouble likely to be? *A*—In the position of the suspension pin or link saddle pin, and in the position of the tumbling shaft

(48) J J. C., So. Dorset, Vt, asks.

Where is the Monitor injector made, what is it like, and how does it work? *A*—This injector is sold from this city, and probably made here It is a simple, lifting injector with independent primer, working on the same principle as other instruments of its class

(49) E. G. R, Mt Savage, Md., asks:

Can you tell me a process by which scales, calipers, etc, can be silver-plated by their owners at home? *A*.—See answer to Question 54 in this paper; there is, however, no way so good or so cheap as having it done where they make a business of such work

(50) J. B F., West Millville, Pa., asks

1 Why will an engine that has large driving-wheels slip more easily than one with small driving-wheels? 2. Why is it that the balanced slide valve saves the wear of valve, valve gear, etc.? 3. What is the weight of heaviest locomotive in service, and where is it? *A*.—1. The large wheel will not slip the most, other things being equal. 2. Because it relieves the valve of part of the load on it, caused by the pressure of the steam in the chest 3. 152,000 pounds, U. P. Ry

(51) W T. B., Minneapolis, asks:

1 In what position should an engine set when setting up wedges? 2 When there are two keys in front end of side rod how should it be keyed? 3 Is it proper to key main rod when engine is on center? These questions all apply to a four wheel switch engine *A* 1 Put the pin on the top quarter and block the wheels on the opposite side, give the engine enough steam to bring a strain on the rods, then shut off and set up wedges; this pulls the box ahead and away from the wedge 2 The two keys in the front of side rod are to admit of changing its length; if there is but one key in the back end, key it first, and then key the front, letting the rod be free laterally, when engine is on the center 3. Yes.

(52) M C. G., Durham, N C., asks:

1. Please give simple rule for setting a slipped eccentric on the road 2 Who makes valve motion models, and what do they cost? *A*—If but one eccentric is slipped, set it by the other one, suppose it is the right back-up eccentric, put that side on either center, put the reverse lever in the forward notch—because the forward eccentric is all right, and the lever throws it into full gear—make a mark on the valve stem close up to the gland, then put the lever in the back notch—this throws the back-up eccentric into gear—now move the eccentric on the shaft *in the direction it is to run*, in this case back, until the mark on the stem comes to the gland again, then fasten; this may leave the engine slightly lame, but she will haul a full train 2 The estate of F. W. Richardson, Troy, N Y., build an adjustable model, worth about $250. Pedrick & Ayer, of Philadelphia, Pa., build one, not so adjustable, but a good one, price about $70. W H. Ermentrout, Reading, Pa, builds an adjustable model of wood that sells for $15.

(53) M R. B., Alexandria, Va., writes

1. I have a lever measuring 25 inches from the fulcrum to end of lever, 5 inches from the fulcrum to valve Valve is 3 inches in diameter, steam pressure 100 pounds per square inch. What weight would be requisite to hold this valve down until 100 pounds pressure is attained in the boiler? *A*—The pressure required to hold down a safety valve is found by multiplying the area of the valve in square inches by the pressure per square inch. In the problem given the valve is three inches in diameter, which gives practically seven square inches of area, it is desired to hold this valve down against a pressure of 100 pounds per square inch, and so the valve must be held down with a load equal to seven times the pressure, or 700 pounds; the valve, and all else that retards the free escape of steam, should be counted as weight If this was a common spring pop, the tension of the spring would be 700 pounds. To find the exact weight, the weight of valve, spindle and lever must be known, and the center of gravity of the lever found Ignoring these we find that, if we follow the well-known rule, and "multiply the pressure in pounds per square inch by the area of the valve in square inches, and this product again multiplied by the distance in inches from the center of the valve to the center of the fulcrum, and the last product divided by the length of the lever in inches, will give a quotient equal to the weight on end of lever" Thus

$$\frac{100 \times 7 \times 5}{25} = 140,$$

the weight required.

(54) D. D. C, Ft. Worth, Tex., asks:

1. Can copper or brass be silver plated without the use of a battery? 2 Will it stand any heat? 3 How can I construct a cheap and simple battery? *A*—1 Material such as mentioned can be plated without use of a battery by the following process Cut into small pieces a silver 25-cent piece, and put into an earthen vessel with a half ounce of nitric acid Put the vessel into warm water, keeping it uncovered, until the silver dissolves Add half gill of water and one tea-spoonful of fine salt, and let it settle. Drain off and repeat, adding water to the sediment until the acid taste is all out of the water Then add one pint of water and four scruples of cyanide of potassium to the sediment Put into this solution a strip of zinc two inches long, one inch wide, and an eighth of an inch thick. After thoroughly cleaning the article to be coated, immerse it in the solution for about half a minute, letting it rest on the zinc strip in the bottom, wipe off with a dry cloth and repeat; then polish with chamois or buck skin, the thickness of plating is increased by repeating the bath. 2. This, or any other than electroplating, will stand but little heat or wear. 3. You can construct a cheap battery by taking a gallon stone jar, and place in it a sheet zinc cylinder—like a piece of stovepipe—then inside the zinc place a porous earthen cup, a flower pot with the bottom hole corked up will do. Inside this porous cup place a sheet, or strip, of copper Use a solution of common salt next to the zinc, and a solution of sulphate of copper next to the copper in the porous cup. Keep the liquids in both vessels at a common level You can, however buy a battery of any dealer in electrical goods that will be much better and much cheaper than any you can make yourself.

A Car-heating Company's Plant.

The writer recently made a hurried call at the shops of the Martin Anti-fire Car-heating Co., Dunkirk, N Y. This company is, so far, the most successful one in its particular line of business, having its heaters in use on ten per cent. of all the passenger cars of the country

The shops are new, well arranged for a manufacturing business, and exceptionally well equipped with tools, many of them being special tools of their own design.

They have a number of pipe-cutting and threading machines that have been designed to do quick work where a great many pieces are made in duplicate.

For valve work they got up a special lathe, that is simply a small speed lathe, with a slide and a chasing bar. For small work it does all that a Fox lathe, costing twice as much, will do, and would be just the tool for railroad shops. These they build for the market Their regular line of work occupies a considerable part of the shops, but several outside contracts are being carried out, some brick machines, tannery pumps, and such work, occupying the lower floor. This company are building the De Kalb car window fixture. This style of window is destined to become popular, as it admits of ventilation without draughts. The sash does not raise, but is hinged by the fixtures to *each side*; a rod runs the length of the car above the windows, and is attached to the fixtures at each window by an arm; by setting this rod either one way or the other it locks one side of the sash and loosens the other; then the window can be shoved *out* on the loose side about four inches, or any part of this amount.

If the window is opened at the back from the way the car is running there is a good ventilation, and no draught or cinders are directed upon the occupant of the car. This is especially true for the occupant of the seat back of the open window.

By reversing the rod the front of the window can be swung out, or, by moving the rod to its central position, the whole sash can be moved straight out This is much better than the class of car windows that raise up about six inches.

Superintendent Barnes has a habit of getting up a special tool for almost everything, and some of them save lots of time. He also designed and built the special high-speed engine used by the company to drive their electric light plant. This engine has a very ingenious shaft governor that maintains a constant lead.

There is here a special design of core oven for small work that is very efficient; the unused fuel dumped from the cupola is enough to dry out all the work they have. The cores are placed on iron shelves, that are simply the flattened tops of the flue through which the heat escapes to the stack

More than twenty years ago Alexander Mitchell, M M of the L. V. road at Wilkesbarre, Pa., asked and obtained permission to build two iron tank frames. There was a great deal of argument against the idea, one of the greatest being that Mason had never built one, always using wood; but Mr. Mitchell built the frames thoroughly braced them, especially about the draught gear, and they are in service to-day, apparently as good as ever The tender frames made by the L. V are the heaviest and best we have seen

It is odd that with all the camel-back engines built and run for years that no one seems to have a good picture of one. We would like to get one.

Why Papers Miscarry.

We get a good many complaints from subscribers who fail to get THE LOCOMOTIVE ENGINEER regularly, and some of them think the publishers must be to blame. We are always glad to receive complaints, whenever occasion for complaint exists, and think nothing is too much trouble that will tend to lessen their number.

In a majority of such cases, however, investigation generally shows that the irregularity is due to want of definiteness in the address. A residence address, mentioning street and number, or a post-office box, is greatly to be desired in making papers carry straight to subscribers living in small towns even

A good many such complaints come from persons who change their address without giving us notice. No matter how often an address requires changing, it can readily be done, and will be done cheerfully. In giving this notice, mention both old and new addresses.

Another class of complaints come from subscribers whose papers are not even subjected to the tender mercies of the clerks employed in the general delivery department of the post-office. Such an one we have before us at this moment—it is a worse case than most—coming from a subscriber whose name we find correctly entered on our mailing list, but whose address is down simply as "R. & D. R. R., Greensboro, N. C." Now we think a street and number address or post-office box would remedy this trouble—not that we think our subscriber's diagnosis of the cause is necessarily correct, our idea being that a dishonest man seldom reads, and we try to make THE LOCOMOTIVE ENGINEER a paper which has charms for honest folks only—but because the address is very indefinite, and covers a large space in which papers can easily get lost without help from any individual. Here is the way our Greensboro subscriber puts it:

I like THE LOCOMOTIVE ENGINEER very much. I am sorry that I don't get it oftener than I do. I subscribed to it last December, and so far have got three copies—those for January, March and June. I am pretty well satisfied you mail them regularly, but I think somebody likes the paper as well as I do, and he gets the first grab at it. If he would just let me know who he is, I would send him a year's subscription, just as a sort of inducement to let mine alone. He certainly must be hard up.

Perhaps you may be able to do something by which I can get my paper Still, I don't know just what it will be. If the fellow who gets it could see this, perhaps his conscience—but I forget, people who steal have none.

A Light Locomotive.

Few railroad men realize how many light locomotives there are in service and to what uses they are put H. K. Porter & Co., of Pittsburgh, Pa., build more locomotives of this kind than any other maker, probably more than all the other makers. Their sizes range from those having cylinders 5 x 10 inches to 14 x 24 inches The styles are numerous, especially designed for certain work, there are little fellows without cabs or stacks, to go down in coal mines, open affairs for plantation use, and iron-clad ones for bloom mills and furnaces. There are truckless ones and some with single trucks in front and none behind, others with trucks behind and none in front, and several different kinds with trucks at both ends.

The drawings show the details of a popular style of street locomotive built by these works, and, as the sizes are nearly all given, there is little need of giving figures. Engines of this style are built with cylinders 7 x 12" up to 14 x 20", the one shown being 10 x 14.

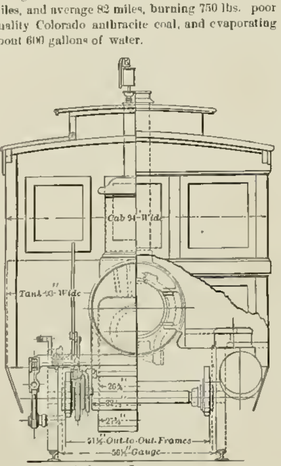
These engines are used in the streets of cities, have a noiseless exhaust, are fitted with steam, air or vacuum brakes, when so ordered, and have all modern improvements that big engines do. They are provided with Packer's easy motion rolling truck, that permits them to round curves as short as 40 feet radius.

All Porter engines are built with a view to renewing worn or broken pieces, and the works furnish parts for all their sizes, this is done because most of the machines sold go away from shops and are generally repaired by men of little experience. Driving tires go upon the wheel center on a taper, and are held on by bolts, by removing the latter the tire can be knocked off with a sledge without any heating at all.

The hauling capacity of this size motor is placed at 575 tons of 2,000 and 1,000 tons for the larger size; they generally haul from 3 to 5 street cars at from 8 to 15 miles per hour. This engine is provided with a pilot at each end, but one was left off in the engraving, to admit of a larger sized picture.

The Muncie Street Railway, Muncie, Ind., has a number of this class of engines with 8x14 cylinder; the road is a standard gauge, 35 lb. rail, 4 miles road completed, 25 feet per mile grades, 50 feet radius curves—usual train 4 8-wheel cars 37 feet long, 9,500 lbs. weight of car, and 220 passengers in train, equal to 32 tons of train. Usually makes 64 miles per 8 hours, burning 650 lbs. coke, and evaporating about 400 to 500 gallons of water. They have run one motor 160 miles in 12 hours.

The Park Railway, Denver, Col., 7x12 cylinder motor, 42" gauge, 3½ miles, 40 feet radius curve, 90 feet per mile grade, 32 lb. rail—usual train 1 8-wheel coach—16,000 lbs., and 140 passengers, when crowded, equal to 15 tons train. Usual mileage 12 to 16, round trips, equal to 84 to 112 miles, and average 82 miles, burning 750 lbs. poor quality Colorado anthracite coal, and evaporating about 600 gallons of water.



A LIGHT LOCOMOTIVE.

Many years ago on the Great Western Railway of England, a spark from the locomotive set fire to a carriage, and a bad accident happened, because there was no means of communication between the guard and the engineer—that was before the days of electric signals, the bell cord or the air brake. After this accident an iron hood containing a seat was placed on the back of all tenders, and a porter was placed therein to watch the train, riding with his back to the engine, the iron hood protecting him from cinders. After several years, no similar accidents occurring, the watchmen were taken off but the seats remained, and on one of the once famous fast engines of the world, "Lord of the Isles," built in 1851, and now on exhibition at Edinburgh, this seat is to be seen.

General Manager Hallstead, of the Delaware, Lackawanna & Western, has notified all telegraph operators on that line that they must withdraw from the Order of Railway Telegraphers, or leave the service of the road. The following objectionable clause in the constitution of the order is said to be the cause for Mr. Hallstead's action: "No member shall teach the art of telegraphy without permission from the superintendent, chief operator or the grand chief telegrapher of the order; attested to by the grand secretary under the seal of the grand division."

Baldwins are building several more of the Mason-Fairlie locomotives, such as illustrated in the March issue, for the Central Mexicano.

Heat, Motion and Work, and their Units of Measurement.

BY F. F. HEMENWAY.

LAST PAPER.

Chimney draught is the result of the difference in temperature between the hot gases in the chimney and the cooler air outside. If the difference between the temperature outside and inside the chimney is slight, the draught will be sluggish; as this difference is increased—up to a certain point—the draught will be increased. But it costs coal to heat these gases to a high temperature, hence moderation is used in that respect. Right at the chimney is a material loss. We must get air through the fire, and to do this we must have chimney draught. The hot gases must also leave the heating surfaces of the boiler at a temperature higher than that of the steam, otherwise they will not impart heat to the water. Without entering deeply into the subject, which lack of time forbids, we shall not be far out of the way in concluding that 20 per cent. of the 14,000 heat units in the coal go up the chimney, and that they are usefully employed in maintaining draught. This will allow for a temperature in the chimney of about 400°. This should be the chief loss about a well-designed and well-arranged boiler; that is, it should exceed all other losses. A little loss will occur from coal falling through the grate, and a little from radiation from the boiler, but the sum of these two losses should not exceed 10 per cent. This would make the total loss of heat at the boiler 30 per cent., leaving 70 per cent. utilized in making steam. The loss may be less than this, but it seldom is less. A loss of 30 per cent. represents good practice.

Unfortunately the loss may largely exceed 30 per cent., and this is what you, as engineers, are interested in. You are interested in this because, when a boiler does not utilize 70 per cent. of the calorific effect of the coal, there is always a possibility of effecting a saving. Regarding loss from radiation five per cent. or a little more may seem a small allowance, but I believe it is ample, but for lack of care it may be greater. In boilers set in brickwork, if the setting is not properly done, the walls made of suitable thickness and joints well made, the loss from radiation may be much more than five per cent. So in boilers not set in brick, if they are not properly protected the radiation will be 15 or 20 per cent., instead of five or a little more. Here, then, is a chance for the engineer to exercise his judgment. The fewest possible metallic surfaces about a boiler should be in contact with the external atmosphere, and the brickwork should be kept tight, with no chance for leakage.

It has been seen that it is necessary to admit about twice as much air to the furnace as would be necessary under perfect conditions to produce combustion. The heating of this excess of air will require about half the heat that is lost at the chimney, even under favorable conditions. But if, instead of admitting only twice the quantity theoretically necessary, three or four times that quantity is admitted, it will be readily seen how the loss at the chimney may be doubled.

Air is for the most admitted to the furnace through openings in the grate bars. Now to get along with the least quantity of air it should be admitted as equally as possible through these openings, and the fire should be kept in as nearly uniform condition as possible. This permits the atoms of oxygen to more readily come in contact with the combustible atoms, and hence makes it possible to utilize more of the oxygen. If the air finds its way into the fire in a few places only, steam may be kept up if the furnace is large for the work, but the air will establish currents of considerable magnitude, which will hinder to a great extent the combination of oxygen and combustible atoms, and a greater surplus of oxygen will pass off through the chimney, carrying with it heat from the furnace. So if there are bad places in the fire air finds its way through, wasting heat. Whatever the size of the grate, it should be kept in equal use all over; if too large for this it should be made smaller, and all air spaces kept open.

But while there is loss from admitting too much air to the furnace, there may be even greater loss from admitting too little. Let us see how this is. The product of the combustion of carbon we have seen is carbonic acid, 2⅔ pounds of oxygen uniting with one pound of carbon to produce this. Carbonic acid when at a high temperature very readily dissolves carbon, and if the supply of oxygen is not sufficient it will so dissolve it, with danger of great loss of heat. When 2⅔ pounds of oxygen unite with one pound of carbon, the result is 3⅔ pounds of carbonic acid. Then if the conditions were entirely favorable for the purpose this 3⅔ pounds of carbonic acid would dissolve another pound of carbon, making 4⅔ pounds of carbonic oxide; not only would the pound of carbon that was dissolved by the carbonic acid be lost, so far as the producing of heat is concerned, but a large amount of heat would disappear in doing the work of dissolving the carbon. While one pound of carbon completely burned to carbonic acid will yield 14,500 heat units, if it is permitted to dissolve another pound of carbon the available heat of the two pounds will only be 8,800 heat units, the heat per pound of carbon being only 4,400 heat units instead of 14,500. While it would not be possible to perform in the furnace of a boiler so complete an operation as this in the way of making carbonic flames will break out, frequently with a weak explosive sound.

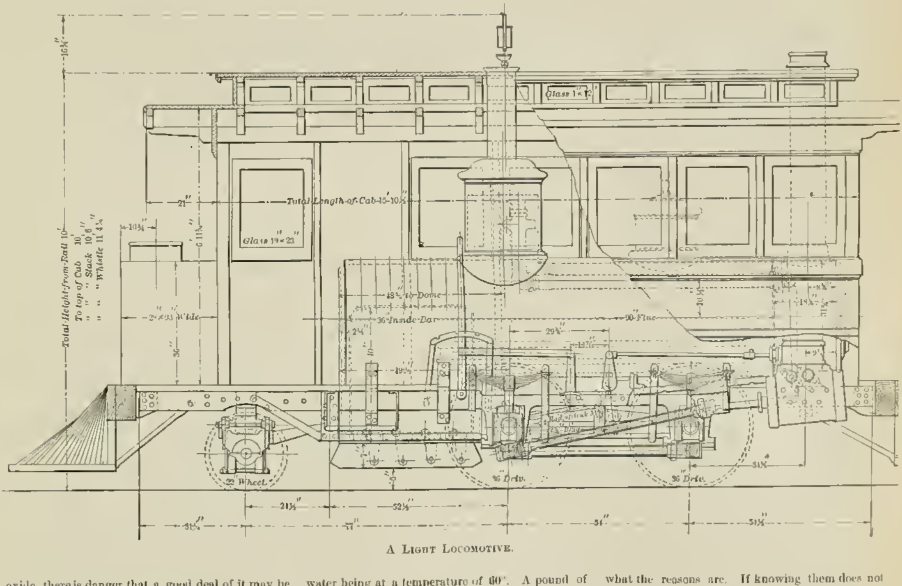
It requires all the skill of the skillful engineer to do so simple a thing as to burn coal without waste. The closest observation is necessary, and he should keep a record of his observations. By this means he will come to know the result of pursuing different plans, and learn to adopt the best, under whatever circumstances he may be working.

Under favorable conditions we have concluded that we can utilize 70 per cent. of the heat of coal in making steam, and as, under fairly good conditions, but eight per cent. is utilized in the steam engine, we must conclude that the loss is not chiefly in the boiler. I mention this particularly because not long since, in a technical journal, I read the astounding statement that more than 90 per cent. of the heat from the coal was lost in and about the boiler.

Let us see what this 70 per cent. of heat utilized in the boiler will do in the way of making steam. We put the heat value of one pound of coal at 14,000 heat units. Seventy per cent. of this is 9,800 heat units.

First let us see what heat will be required to vaporize a pound of water in an open vessel, the —heat of the steam. It is in no way hidden, but has disappeared in doing work. This heat, as heat, is not in the steam at all. This so-called latent heat of steam varies with the pressure, but at whatever pressure you make steam you always have to do with it.

But let us take a case that more nearly represents average practice. Say we are making steam in a boiler at 80 pounds gauge pressure, and that the water supplied to the boiler is heated by exhaust steam to 212°. By referring to steam tables, we find that a pound of steam of 80 pounds pressure contains 1,213 heat units, and subtracting the 212 heat units in the water leaves 1,001 heat units to be imparted. Dividing the 9,800 heat units which we find available in the pound of coal by this gives us 9.78 pounds of water that this pound of coal will evaporate under gauge pressure of 80 pounds, the feed water being heated to 212°. But to do this the conditions must all be excellent, and the coal of a good quality. In practice, if you do not find that you are evaporating from 8½ to 9 pounds of water, at ordinary pressure, for each pound of coal burned, you ought to look about for the reasons. They may or may not be such as you can control, but whether they are or are not you ought to know



A Light Locomotive.

oxide, there is danger that a good deal of it may be made, and pass away unconsumed. I say unconsumed, for if this carbonic oxide is, while hot, supplied with sufficient oxygen, it may be burned without loss. Hence the utility, where deep fires are burned, of admitting air above the fire.

Now the engineer is, so to speak, between two fires. If too much air is admitted then there is a loss; if too little there may be a greater loss. This is something in regard to which an engineer must in the main be his own guide. All of you who have had considerable experience in burning coal know with more or less certainty by the looks of your fire whether or not it is burning properly. You know you must not have air holes in it, and that it should have that peculiar live and even appearance that no description can cover. With any kind of coal, if there are dull places in the fire, it means waste. In regard to the great waste incident upon burning coal to carbonic oxide instead of carbonic acid, I never knew any means of judging by the appearance of the fire except this: If a considerable quantity of carbonic oxide is escaping, the surface of the coal will have a dead, uneven appearance; and upon partially opening the fire-door, thus admitting air above the fuel, irregular blue water being at a temperature of 60°. A pound of water at 60° contains, near enough for present purposes, 60 heat units. Water boils under the pressure of the atmosphere at 212°, and a pound of water contains at this temperature—let us say to avoid confusion, and because it is near enough correct for our purpose—212 heat units, reckoning as we are all the time from zero of the Fahrenheit thermometer. When we have applied 212 less 60 equals 152 heat units, the water is at a temperature of 212°, and begins to boil, and to pass off as steam. If we keep on until the pound of water is all converted into steam we shall find that we must apply, in round numbers, 966 more heat units, but the temperature of the water will not have been increased. It required the application of 152 heat units to increase the temperature of the water from 60° to 212°, and then 966 more heat units to do the work of vaporizing the water. These 966—or more exactly 965.7—heat units that have disappeared because they have not brought about any increase in temperature, constitute what is called the latent heat of steam at atmospheric pressure.

If scientists of the present day were to find a name for these 966 heat units that have disappeared, they would not call it the latent—that is hidden what the reasons are. If knowing them does not help you at the present, there is every probability that it will in the future.

The greatest proportion of the heat, then, has, we must conclude, passed out of the cylinder of the engine with the exhaust steam. This is something that, in the present state of the art, we cannot avoid, and while we cannot at this time follow the subject exhaustively, it is a subject to which, as engineers, you should give a good deal of attention. In a general way, then, we know that the steam, when the exhaust valve opens, contains a very large proportion of the heat that has been imparted to the water in the boiler. But although there is great loss of useful effect in the engine that cannot be avoided, we know that one engine may be, and is, much more economical than another, and that the management of an engine may be such as to vary, very materially, its economy. Here, then, is room for work.

Let us begin with the steam as it leaves the boiler. From that time on it will get no more heat. On the contrary, from that time on it will lose heat, which means that part of the steam will go back to the condition of water. If we were to fill the steam pipe with steam at boiler pressure, and close a stop valve at each end, we should find the pressure in the pipe gradually growing less. The steam would return to its condition of water, giving up its heat to the surrounding atmosphere, and, as the water would occupy only a small fraction of the space occupied by the steam, the pressure would fall as condensation went on. This condensation, and consequent loss, goes on when steam is passing from the boiler to the engine, but the lowering of pressure is prevented by the free communication with the boiler. Still the loss goes on, clear through the boiler to the source of heat, the coal pile. Now this loss will be in proportion to the extent of the exposed surface of the pipe, and it will be greater or less according as the pipe is protected from contact of the atmosphere. Here, then, is where saving may begin, outside the boiler. It is not only a loss of heat when we permit the steam to be condensed in the pipe, but water is introduced into the cylinder of the engine, which is something we want particularly to guard against. We would naturally, then, conclude at once that—first, our steam pipe should be as short and as direct as possible; and second, that it should be thoroughly protected from the atmosphere. It is a matter of astonishment in these days, when it is so easy to obtain covering for steam pipes, to see so many of them unprotected, giving out heat where heat is not wanted, and calling for the consumption of coal for a worse than useless purpose. This loss of heat is one that the engineer should understand, and use his best efforts to guard against.

Then the same argument that applies to the steam pipe will apply to the engine cylinder. It pays, most decidedly, to protect it from loss from radiation. I am inclined to believe that it pays to do this more than any figures will show, and I believe this from a little personal experience more than fifteen years old. I was called upon to make some quite material changes in a vertical engine driving a woolen mill. I made the alterations, and very carefully indicated the engine to see the result. The engine-room was not large, and an upward extension of the roof had been made for the cylinder, and there was a cover over this that could be raised to ventilate the room. Although the weather was quite cold, I found it uncomfortably warm up in this little extension, and after a time I raised the cover. I went on taking diagrams, and after a few minutes—perhaps fifteen—I found those diagrams taking on a form that, knowing all the conditions, I could not account for. I took my indicator down and carefully examined it, but it was in perfect condition. I thought several times of the open skylight and the large exposed cylinder head, but it did not seem possible that this could be the cause. It seemed that I must make a change in the valve gear to cover the loss shown by the diagram. Finally, more as a matter of curiosity than anything else, I closed the skylight, and in a few minutes the diagram was all that I could desire. I then tried the experiment of opening the skylight and covering the top of the cylinder with a lot of bagging collected around the mill, and the result was entirely satisfactory. Since then I have made other experiments in the same direction, and the results have been such as to satisfy me that there is a greater loss from unprotected cylinders than we are inclined to believe in.

Again, we know that economy in the use of steam in the steam engine is largely brought about by working steam expansively. To put it in a general way, we know that if we take steam in the cylinder at boiler pressure, and maintain that pressure to the end of the stroke, we can do a certain amount of work, using a cylinder full of steam to do it with. Then we know that if we fill the cylinder one-quarter full of steam, cut off the admission and let the imprisoned steam do work while expanding from a higher to a lower pressure, a good deal more than one-quarter of the work will be done. Now the engine that the stationary engineer has to do with is generally already made, and hence he cannot control the matter of working steam expansively, as he might like to do. But as most engines that are built at the present day are made to automatically cut off steam to control the speed, the engineer, by remembering that a little higher boiler pressure will bring about earlier cut-off, and hence, if the engine is fairly loaded, better economy, frequently has it in his power to effect a saving in this way.

The engineer may also bring about a saving by always bearing in mind the fact that friction is lost work, and that by using proper oil, and giving the required attention to lubrication, the coal-bill will figure in the result.

By way of recapitulation, we may safely say that while the least loss—as we use the term—in a steam plant is generally in and around the boiler, there is abundant opportunity for saving, all the way from the time the coal comes to hand till the exhaust steam gets beyond control. Next to safety, the economical use of fuel should be the engineer's study. A great deal can be learned through books and periodicals, but a large part of the engineer's knowledge must be gained by experience. Still the experience of a single individual can cover but little ground, and without a knowledge of the experience of others he is constantly working in unprofitable directions.

I am aware how little one can say in a talk like this. If I have touched upon a point or two in such a way as to lead you to further investigation, I am quite satisfied. It is certainly a pleasure to find so many earnest men seeking information as we find at the present day. It means progress for them and progress for the world. The typical soldier is the private, the man who carries the musket or mans the cannon; the man who digs the trenches and then defends them; who throws up fortifications and then fights behind them; the man who does the real work of the campaign. We exalt the general who plans, who issues the orders and takes the credit if there is any; but we turn to the soldiers who do the work and brave the danger, if we want to form an opinion of the character of the army. The general may direct never so wisely without meeting success unless the rank and file of his army is of the right material, properly equipped and instructed in their duties.

So it is in other affairs. We judge a nation not by the brilliancy of a few of its great lights, but by the standing of its masses; by the intelligence of those who produce common things. The millionaires of a nation do not make it rich, nor does the standing of a half-dozen thinkers constitute a valid claim for intelligence. The financial condition of the men who work establishes the condition of a nation as to wealth, and the mental condition of the people, as a whole, constitutes its intelligence.

A few years ago, as time goes, there was little call for steam engineers. To-day the stationary engineers alone constitute a great army, while there are upward of 30,000 on locomotives. There is placed in their hands a vast amount of wealth. To better fit themselves for their duties, engineers everywhere have entered upon an educational crusade. The demand for better engineers is sure to follow. Those engineers who do not join the ranks and push ahead are sure to fall behind in the race. It is hard work swimming against the current when that current is the current of progress. Engineers and all other workers in the great industries that make up about all there is of life, are fast finding this out.

Workingmen are apt to think that education, to be of much avail, must be had through some regular institution of learning. I have not a word to say against such institutions. They play an important part in the affairs of the world. But I have this to say. In this practical world in which we live no one cares how or where you get your knowledge. No institution in the world can make engineers of you. You must make engineers of yourselves, and you can do that though you never see even the outside of the great institutions of learning in the country.

The engineer who makes one pound of coal do that for which two pounds were required, is as much a public benefactor as is the man who makes two blades of grass grow where one only grew.

Some Little Comforts.

On some of the Flint & Pere Marquette engines they put a piece of 4-inch pipe about a foot long into the exhaust pipe from the air-pump, the regular sized pipe entering the bottom at one end, and going out near the top at the other, then a small drip pipe from this trap is provided that keeps all the water out of the pipe, and helps the boys keep their engines clean.

Here the blower pipe and exhaust from the pump do not enter the smoke arch, but go over it, outside, to the base casting of the stack.

The cinder slide is operated from the fireman's seat, and can be done when running, but is not, as cinders are dumped dry; the plan saves many steps for the men.

These engines have a fire-door that swings from the top and opens into the fire-box, becoming a deflector when open; this door is the same as that designed by Master Mechanic Hill, of the Camden & Amboy, some years ago, and similar to the English door of the same kind.

An apron made of an old belt, and ironed all around the edge on both sides, with strips an eighth of an inch thick and two inches wide, makes a quiet rig that lays down and stays down, requires no hinges, and prevents slipping in bad weather.

The engines rebuilt by this road have a very neat boiler, with dome ahead of sand-box, using a very short dry pipe.

Piston valves, designed by the general superintendent, who was formerly an engineer on the road, are being tried, the first set having now been in use seven months, and still tight.

The Pennsylvania Railroad Company buy all their oils, both lubricating and illuminating, by weight, and distribute them in the same manner. This practice has been found far superior to the old, half-guessing plan of measurement. The plan is in much favor now, though opposed at first—as all changes are. As it is necessary to weigh each can and its contents, exact weight of amount given is charged to engines or cars. When a fireman takes his can to the oil-house it is hung on a spring balance and filled there without the use of measures. It is claimed that the weighing plan takes just about half as long as measuring did, and is much more accurate.

The railway mileage of the world at the beginning of 1889, according to the best authorities, aggregated a little over 357,000 miles, divided among the continents as follows: Europe, 133,900; America, 190,000; Asia, 17,800; Africa, 5,200, Australia, 10,500. Thus new America has already much more than half of the entire railway mileage of the globe, and is yearly gaining with great rapidity upon the older continents and nations. The United States have about 160,000, or nearly 45 per cent. of the grand total, and this country is every year building more than the entire railway mileage of many of the European nations.

Richard McDowell, of Lambertville, N. J., has patented a sand-box and drier for locomotives. He places an ordinary shaped sand-box around the stack in one form, and in another makes the box in the shape of a saddle tank on the smoke arch, while in still another form a box is located on each side of the extension. His idea is to use the smoke-box heat to dry the sand, doing away with driers. The plan may have some advantages, but it has the disadvantages of weight in the wrong place and excessively long sand pipes.

If there is any of our readers that wants to become a bright and shining example of modern railroad journalism, and has a cool thousand or two to invest west of the Missouri River, we can point out to him an opportunity the like of which has not laid out-door since H. Rider Haggard abandoned King Solomon's Mines.

In early days, when the Texas Central only reached from Houston to Bryan, the road killed a great many people and no end of cattle, and was nicknamed "The Angel Maker."

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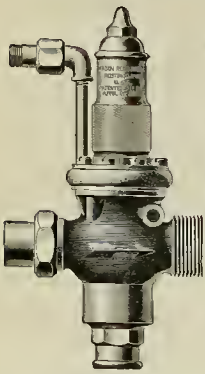

For nearly two years this Regulator has been thoroughly tested on air brake pumps. During this time not one Regulator, out of 100 which are now in use on the Boston and Albany and Fitchburg Railroads, has been taken apart for repairs or cleaning. As the air chamber is entirely separate from the working parts, dirt from the train pipe cannot affect it. It can be applied without changing any of the present fittings, and we should be pleased to send one on trial to any railroad. Price $15, Net. Address

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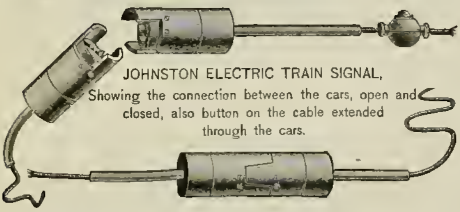

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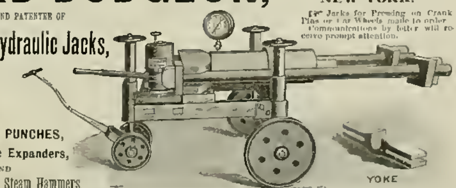

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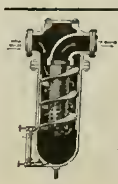

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Extracts Oil and Water—Saves the Roof.
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THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 9 | NEW YORK, SEPTEMBER, 1890. | $1.00 per Year or 10c. a copy.

A Model Passenger Locomotive.

The neatest design of an eight-wheeled passenger locomotive that we have ever seen is shown in our first-page illustration.

This is an anthracite coal burner just turned out of the Lehigh Valley shops at Wilkesbarre, Pa., by Alexander Mitchell, M. M. and Supt.—the designer of the first consolidation. This engine presents a very neat appearance, has nothing on her for show in the shape of brass or bright paint, but is as hand some a locomotive as is often seen—a finished machine.

The long, Belpaire fire-box sets on top of the frame and does not extend over it, as in many new engines now being built for hard coal. The cab is placed just over the drivers and ahead on the fire-box, this makes it easier to ride, keeps the cab free from dirt and smoke, and gives the engineer a better chance to see. The running boards, both in front and behind the cab, are wide, the ones at the rear protected by outside railings. In the cab special attention has been paid to getting things handy and comfortable for the men; the brake valve is on top of the boiler, but has a long, bent handle that comes down within easy reach.

Just under the throttle lever there is another lever, pivoted to the boiler, with which the runner can put on the left-hand injector, both right and left-hand injectors being operated by levers—they are Sellers', re-starting.

Good cushioned seats and arm-rests are provided, and all the cocks and levers placed so as to be easily reached from the seat.

The cut on page 162 shows the arrangement of braces in the Belpaire boiler, as well as a rear view of the engine.

On the back end of the boiler there is an iron shield for the fireman, and a steam gauge, to save him the trouble of going to the cab to note the pressure.

The fire-box drops some ten inches in front, and is provided with water grates 11 feet long.

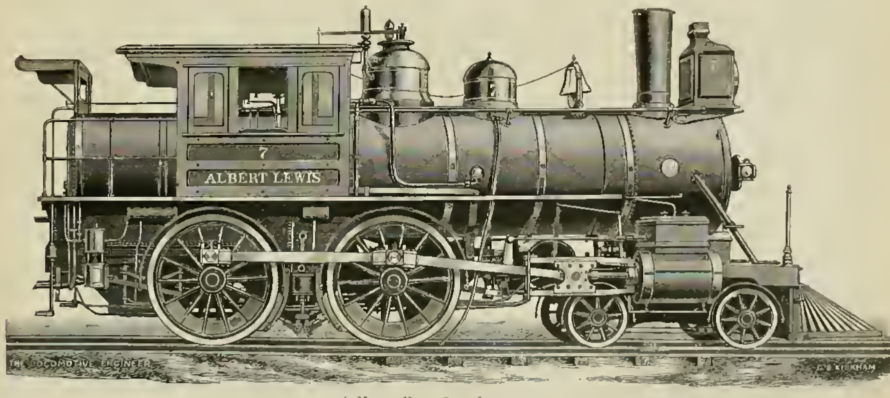
The extension is short and provided with one of the well-known L. V. cinder-boxes located under the front and between the frames.

With hard coal the fireman is employed in firing a very small part of his time while running, and can therefore spend a good deal of time in the cab, but with soft coal, requiring constant feeding, we doubt the desirability of separating the engineer and fireman; still the fireman is not of much use as a look-out when working with his fire; if the cab is set ahead on a soft coal engine the fireman should be provided with a comfortable cab of his own. That it is cooler, cleaner and easier riding in a cab placed near the center of the boiler, and that it is safer, and the view of track better for the engineer, we have never heard disputed.

This boiler has been very carefully designed and built, and at the top and sides of fire-box where it joins the barrel, as shown at *A* and *B*, page 162, there are heavy stiffening plates.

The principal dimensions of the engine are as follows:

Gauge of track	4 feet 8½ inches
Total wheel base	22 feet 11¼ inches
Rigid " "	7 feet 6 inches
Total weight	103,040 lbs.
Weight on drivers	75,488 lbs.
Weight on trucks	27,552 lbs.
Diameter of drivers	68 inches
Cylinders	19x24 inches
Delancey's balanced valves.	
Lap of valve outside, 1 inch, inside lap	3-32 inch
Travel	6 inches
Size of steam ports	1⅝x17 inches
Size of exhaust ports	3x17 inches
Boiler, steel	7-16 inch thick
Diameter of smallest boiler ring	58 inches
Grate surface	89 sq. feet
Heating surface in fire-box	185 sq. feet
" " " tubes	1,520 sq. feet
Tubes, 250, 2¼ inches diameter	11 feet 8 inches long
Outside throat sheet	⅝ inch thick
Fire-box sides	5-16 inch
Crown sheet	⅜ inch
Flue sheets	½ inch thick
Diameter driving axle	8 inches
Length of bearing	10 inches
Throw of eccentric	2½ inches
Width of eccentric	3 inches
Size of nozzle, double, each	3¼ inches
Capacity of tank 3,000 gals., weight loaded	60,000 lbs
Height from rail to top of stack	14 feet 1 inches
Service, passenger; grades, from	96 feet to 145 feet



A MODEL HARD COAL LOCOMOTIVE.

Complaint about common snap ring cylinder packing is invariably heard where it is put in wrong. Plain snap rings for cylinder packing are the cheapest and handiest packing, and will give good service, if given a show. After turning to within a quarter of an inch of size, and facing the sides, the ring should be cut, and a piece taken out, say one inch long for 18 inch rings, then spring the rings together, and turn the outside true; rings made in this way are round to start with, and have considerable spring or life, and will be tight. Springing rings into the cylinder that have not been trued up after cutting, is a poor plan; the rings never fit.

Where the Different Classes of Locomotives Got Their Names.

It is a little curious to note how different classes of locomotives got their names; most of them were named after the first or trial engine, but some were not

Geo. Stephenson's "Rocket" was a success, and upward of a hundred locomotives were built on its general plan, and called "of the Rocket class" or "like the Rocket" Following on the line of the Rocket, but an improvement on it, was the engine named "Planet," that raised after it a large family of "planets," of which many of the first successful locomotives built in America were members

The "Grasshopper" engines were so named because of the peculiar walking motion of the walking beams and connecting-rods, the first of the class was named the "York"

The "Crabs" were used, like the "Grasshoppers," on the B. & O., and had vertical boilers, but horizontal cylinders and an intermediate shaft, geared to the driving axles. They were named, it is said, because of their resemblance to a crab, in that they go when they look least as if they would.

Ross, Winans' "Mud-digger" was an 8-wheeled coupled engine, with the engine shaft geared to the drivers. They got their name from the fact that their weight and want of equalization pounded the old strap rails and ties on damp ground enough to throw lots of mud upon themselves and the trains.

The first engine Winans built, in which the pistons were coupled direct to the wheels, had a sloping fire-box, and in consequence, the cab was placed on top of the boiler, and this suggested the name "Camel," which was used for the first one, and the whole class of upward of 200 engines were called "Camels," and "Camel Backs."

The 8-wheeled engine became so popular in this country that it is known in all foreign countries as the "American locomotive."

The 10-wheeler followed the 8-wheeler; the first one was built by Norris, and named the "Chesapeake"

The first engine in this country to have six coupled wheels and a pony truck was named the "Mogul," and the name has followed the class, just as the name "Consolidation" followed the first 8-wheeled connected engine having a pony truck.

The first 8-wheeled coupled engine with double truck was named "Champion," but the class was named "Mastodons," and "12-wheelers," but very few were ever built when the first engines with ten coupled wheels and a pony truck were built they were named "Decapods"—meaning ten-legged—to distinguish them from the other 12-wheeled, or Mastodon engines.

The Forney engine, which has the engine frame lengthened to carry the tender, took its name from its inventor, M N Forney. This engine has no truck under the engine proper

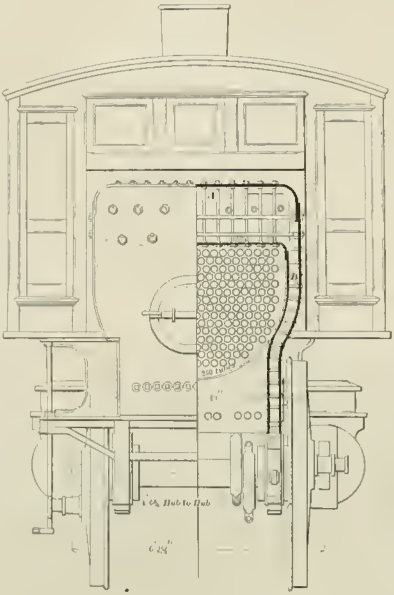
The Fairlie engine first designed in Europe, was introduced into this country by Wm Mason The peculiarity of this engine was the arrangement of the engine under the boiler, like a truck under a car, with a flexible steam pipe Mason added to this flexible engine Forney's extension of the frame to carry the tender, and the combination was called the "Mason-Fairlie," without regard to the number of drivers; there were 4-wheelers, Moguls and Consolidations of this class

It is a curious fact that no class of locomotives have ever been distinguished by any other peculiarities except the arrangement of the wheels. There are different classes known locally by some attachment or part that makes them peculiar, like the Wootten boiler, or the Belpaire fire-box, but the number and arrangement of wheels has been the distinguishing features of the classes

The death of Geo. W Tilton will probably put a dampener on the use of Swinerton, flat spotted driving wheels on the C & N W that was promised.

The Nautical Engineer.

"Speakin' of hook motions," said the old-timer, dropping his hat into the corner and crossing his legs as if he intended to stay, "speakin' of hook motions reminds me of a little circumstance as happened in '67, on the old M. & M Dick Shindler was running a 'nold gun-barreled Taunton and put her in the shop along in the fall rush. Dick was mised a sailor, some'rs down East, and went firin' sorter late in life, but, after all, makin' a more or less fairish engineer, but he stuck to all his old sailor talk. The gauge was a 'compass,' the cab 'quarters,' the caboose 'fo'cassle,' and the reverse lever the 'tiller' Well, as Dick's kittle was in, he got on the extra list, and finally one day he had to take the old twenty-five out on construction, this same twenty-five was a 'nold Dicky Norris hook, with independent cut-off, and what Dick didn't know about that kind of a 'nengin would fill a 'hole 'cyclopedi'a an' a pamphlet besides



A MODEL HARD COAL LOCOMOTIVE

"Things come his way, howmsoever, until about twenty miles out, when he had some switchin' to do; Dick got the handles mixed up and stuck acrost the frog. He tried every which way to move her, but the twenty-five was restin' to stay, and Dick finally concluded to disconnect her which he didn't exactly know how to do, being used to a link Well, after delayin' every one on the road two or three hours, one of the passenger trains flagged agin' him, expectin' to find him off the track The passenger engineer showed Dick how to handle her, and, to make a long story short, he finally got in, plumb disgusted.

"The sup'erinten'ent, as usual, jumped onto the master mechanic, and when Dick arrived the old man was waitin' for him, with his dander up.

"'What'en thunder's the matter with the twenty five and you, anyway?' sais he, 'don't yer know you bisniss?'

"Dick slid down from 'aloft' and sais, sorter respectful like, 'Cappen, that's the crankiest craft I ever sailed, dod blast her rotten bottom, she wouldn't luff nor she wouldn't stay'

"There was a twinkle in old Frosty's eye as he sais: 'I don't know as to your luffin', but it appears to me that you're both monstrous on the stay—you stayed pretty much all day;' then he went off laffin' to hisself"

New Feature in Railroading.

Our readers will be surprised to learn that all special trains leaving Denver on the various lines are numbered. This new feature has been introduced by the *Rocky Mountain* editor of the railroad *News* (exclusively). Some one told him that when verdant cloths fluttered from the front end of a U. P. cloud pusher, that that meant "special train." Looking through the lattice work of the great iron fence the other day, he saw an extra pulling out, and as he caught the figures on the wrecking car, he whipped out his note-book, and people "in railway circles" read in the *News* next morning that special train No. 015 left over the Union Pacific at half after 4 yesterday.

We railroad editors may go wrong on changes and promotions, but you can't fool us on green signals. Cuz we kin see 'em. See!—*Western Railway.*

The Federation of Railway Employes, representing the firemen, trainmen, conductors and switchmen, on August 25th declined to order a strike in aid of the Knights of Labor strike on the N. Y Central. Their supreme council express themselves as satisfied that the Central is waging a war of extermination on the Knights, and give them sympathy and moral support, but no sympathetic strike The council lived up to its laws strictly, and it did well in so doing—there are lots of easier ways of committing suicide than by a sympathetic strike. The cast-iron laws of the Federation make the way to a strike long and narrow—and there is no short cut to it.

The British steamer "Wellington," which arrived at San Francisco recently with coal from Departure Bay, went to Long Bridge on arrival to take on a locomotive which was to be shipped to the Esquimalt & Nanaimo Railroad, which operates a line from the Union Mine to Departure Bay, B. C. The steamer went up with her inward cargo on board so as to be low in the water and facilitate the placing of the locomotive. The locomotive had been hauled from the cars to a platform on the dock, and the steamer made fast alongside the wharf, port side to. A stout gangway was built from the dock over which the locomotive could be transferred to the ship, but while it was being lowered, the tackle snapped and the locomotive broke loose. It tore across the deck, crashed through the iron bulwarks on the starboard side and fell into the bay. The locomotive weighed sixty-five tons and sank so far in the mud, which is there about forty feet deep, that it could not be found when sounded for the next day.—*Ry. Topics.*

The railways of Peru are having a little life put into them again after a long period of idleness following the disastrous war with Chili. The Peruvian roads are built on the American plan, and equipped with American rolling stock, while the roads of the Argentine are principally equipped with English stock.

Another terrible warning against carelessness by railway employes, even in the smallest things, is given in the shocking accident on the Old Colony railway, by which at least nineteen lives were lost, while many others were injured. It appears that section men who were at work on the track failed to remove a track jack which they were using as the passenger train came thundering up, and that the engine was derailed by the obstruction and dashed against a stone wall, followed by several crowded cars, with most appalling results. Justice demands that carelessness which has such awful results should be followed by severe punishment.—*Ry. Age*

That is all right enough, but it should be remembered that the best and cheapest track jack is one that does not stand above the rails, and can be left in place while trains are passing. That the trackmen of this country get the thousands of clumsy jacks off the rails in time for the trains is a wonder.

Simple Lessons in Drawing for the Shop.

By Orville H. Reynolds.

ELEVENTH PAPER.

While the ability to make a correct representation of a machine, or any part of the same, by means of drawing instruments, is something to be proud of, to be able to neatly execute a free-hand mechanical drawing is also a creditable accomplishment, but one not possessed by all.

The end to be sought, however, is a sketch, whether well or poorly done. The importance of this is evident when we wish to convey an idea graphically, for then a few strokes of the pencil will do more than the most voluble tongue.

A free-hand drawing is a delineation of an object by means of the pencil, and with no aids other than the hand and eye, by which the several parts are shown, and the dimensions marked on for reference when making the finished drawing to scale.

A sketch may include a few vague marks in the sand, made by the toe of the artist's boot, or hieroglyphics scrawled with a piece of chalk on the first convenient place. It also may embrace a picture, made by the genius who has discovered that there is merit in the graphite, and who has given us the rough sketch, so-called, we may presume, because it *is* rough.

All the above may fill their little niche, but the ideal sketch is made by those who are familiar with projection, and who, guided by those rules, are able to intelligently place their drawing on paper, whether a copy of something already made or of their own design.

In making sketches, we will require, besides the pencil, a two-foot rule, with which to take our measurements, and a pair of outside calipers, to get the diameter of circular parts.

A little memorandum book, 5"x7", will be convenient to make sketches in, because the stiff board covers make it easy to hold in the hand, and it will be found better than separate slips of paper, as the sketches will always be found between the covers, and not lost or scattered when wanted.

The sketch being a preliminary to the completed drawing, it follows that the more nearly we make the sketch to look as the drawing should when completed, the plainer will it be to work up on drawing-board. If not to be used to draw from, but to be worked to in the shop in place of the drawing, as frequently happens when the drawing office is pressed for time, the sketch must then be made plain, the dimensions should all be put in their proper places, and square or circular parts shown or marked as such, the same as would be done on a finished drawing made to scale.

The hand, unaided by the T square, will, in free-hand practice, be likely to prove unruly at attempts to make a straight line, therefore the first thing of importance is to hold the pencil easily and surely between the thumb and third finger, with the first finger resting on top of pencil. The fingers should be nearly straight, and not too close to the pencil point. In this manner the pencil is firmly held and truly guided.

Straight lines should be practiced first, like short ones shown at *A*, Fig. 71, making their alignment as perfect as possible, then longer lines can be tried, having lengths equal to each other, as at *B*, Fig. 71, after which two parallel lines can be practiced, as in Fig 72.

A horizontal line, bisected by a perpendicular, is shown in Fig. 73. A perpendicular, crossing a horizontal line, is given in Fig. 74 This is a construction required so frequently to do duty as center lines, that it would be well to become proficient in the handling of it.

Fig. 75 shows six radial lines of equal length and equal angles, with ends of radial lines connected by straight lines, and having a circle inscribed within the hexagon. To sketch this figure, make a dot with the pencil point, around which make six other dots, which shall be at an equal distance from the central point, and also from each other, connect the dots by straight lines, passing through the center, after which connect the radial lines, and mark in the circle touching the sides.

To copy a bolt, as shown in Fig. 76, lay it down so as to present the side as shown; draw the center line, and near the top of same draw two parallel horizontal lines to represent the thickness of head, lay off four pencil dots, two at top and two at bottom, as nearly as possible equally each side of the center line, and draw through the dots, to represent the diameter of bolt; the length of bolt should be made to bear something like a reasonable proportion to the diameter.

For the width of head across flats, or the wrench fit, set off each side of center line a dot, as in case of the body, and draw to the horizontal lines The arcs to represent the chamfer can then be drawn

The next operation in this sketch is to show the thread, which, being a United States standard, it will be only a waste of time to delineate it as such, but instead we can adopt the shorter method of lines inclined to the axis of bolt, long and short ones alternating as shown. The short lines, representing the bottom of thread, should fall short of the bolt's diameter by the amount of depth of thread at each side; the longer lines, representing the top of thread, will, of course, be drawn the full diameter, which will answer all purposes for a sketch, and is thorough enough on a finished drawing of V threads, when the pitch or number of threads is given, as it should be in all cases, for the information of those who are not familiar with the standard

The standard referred to also decides the thickness of head and nut, as well as the distance between flats, for a given size of bolt.

In Sellers' "Treatise on Machine Tools" is found the following, bearing on this subject. "The distance between the parallel sides of a bolt head and nut, for a rough bolt, shall be equal to one and a half diameters of the bolt, plus one-eighth of an inch. The thickness of the heads for a rough bolt shall be equal to one-half the distance between its parallel sides. The thickness of the nut shall be equal to the diameter of bolt. The thickness of the head for a finished bolt shall be equal to the thickness of the nut. The distance between the parallel sides of a bolt head and nut, and the thickness of the nut, shall be one-sixteenth of an inch less for finished work than for rough."

When thread is left-handed, it will have an inclination in the opposite direction from that shown in Fig. 76, and should be noted on sketch as such The dimensions are next to be placed where they belong, in order that we may know what size to draw the bolt. First take the diameter of body with the calipers, and noting the size on the rule, mark it on the bolt in a space between two dotted lines, having darts or arrow heads indicating what points the size refers to, making two small dashes at the right and above the dimension to indicate inches (one dash in this connection would signify feet).

The distance over all on the bolt is understood to be from underside of head to point; we therefore measure this distance and place it as shown The length of body, which is from underside of head to inner end of thread, is likewise measured and its size also marked on; next the thickness of head and width between parallel sides of same, and we have complete working sketch of a one-inch bolt.

It will be observed that this sketch can be worked to just the same as though it were a finished drawing, the one view of head being sufficient when marked hexagon, as shown

An angle can be copied by taking any number of even inches, say 10, Fig 77, and laying off this distance from the vertex, on two sides, then measuring the opening or number of inches apart of the points on the sides as 5" on sketch, we have the measure of the angle in inches

Our dimensions will also be of use if we desire to find the angle in terms of degrees, since the length 10 would become radius, and the opening 5" the chord, from which, with a table of sines, we can determine the number of degrees, minutes and seconds contained between the two radii.

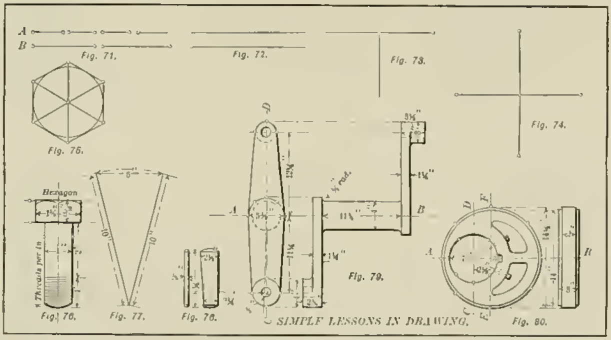


Fig. 71. Fig. 72. Fig. 73. Fig. 74. Fig. 75. Fig. 76. Fig. 77. Fig. 78. Fig. 79. Fig. 80.

SIMPLE LESSONS IN DRAWING.

To copy a piston rod key like Fig. 78, draw two lines, one vertical and the other slightly inclined, to represent the width, which is shown tapering; next draw the straight line at top and bottom, and connect the corners by arcs to represent the chamfers. Two parallel vertical lines are next drawn for the edge view, and the chamfers shown meeting lines projected at top and bottom from side view, same as would be done with T square, these lines make both views of same length. Measure the thickness of key and mark it as shown, find the width at top and bottom and place the figures near their respective ends, lastly, measure the length over all and mark it as shown.

The dimensions are placed as above for the purpose of having the sketch out plainly, which it does because all sizes are contained within the outlines, good practice when size of drawing will permit.

Let us next take a locomotive rocker, Fig 79, and laying it on a bench or some other convenient place, so that we can see it readily, make a sketch of it also. First draw a horizontal line *A B* and erect a perpendicular *C D*, crossing it near the left-hand end, these lines will be our center lines.

Lay off with the pencil point two dots on each side of line *A B* at as nearly equal distances as possible, and draw through them a straight horizontal line, which is the outline of the rocker shaft on side view.

Erect a perpendicular near *B* and draw another line parallel to it, this shows the thickness of upper arm.

Draw another and shorter vertical line at upper end of arm and connect this to the arm by a line at each of its ends; this shows the boss at end of upper arm. Produce the thickness of arm below bottom line of shaft, and draw a short horizontal line which will finish the upper arm. Draw lower arm in same order observed with one just drawn, mark the fillets or curves at the intersection of shaft with the arms, and we have outline of side view complete.

In order to have a good view of the end let us set the rocker on its end *B* and proceed to sketch end *A* We will begin by projecting to center line

C D all points from side view that will be of assistance, as the top of upper arm, after which comes the shoulder and boss on lower arm.

These projected points help immensely in making the two views proportional.

The curves at top and bottom of arms are best drawn by marking three points for the upper and four for the lower, drawing through the dots; this makes a semi-circle at top and a complete circle representing the boss at bottom. Three points likewise made for the curve of shoulder at top of lower arm, using intersection of center lines for an imaginary center, will, when drawn through, give the shape of arm at *A*. Lines now drawn tangent to these curves give outline of end view.

The holes in top and bottom arms are next drawn, when we can put on our dimensions.

Measuring the distance across the lower arm at its greatest width, we draw the dimension line and place the size $5\frac{1}{2}''$ within it as in other cases; taking the diameter of boss at lower end we mark that in also. Calipering the shaft we get the diameter and mark it on as shown.

The length between the arms is next taken and put on the sketch, also the thickness of arms and length of bosses, together with the size of holes at top and bottom. The radius of fillets is then measured and put on, when, after getting the length of arms from center to center, we have a thorough free-hand sketch of a rocker, one that can be worked to if necessary, and one that can be worked up into a drawing at any time because the sizes are all there. One more matter is to be looked into before leaving the rocker if we happen to be strangers to the build of the engine, and that is to determine whether or not the arms are in line as shown on end view.

To know this, lay the rocker on its side on a face plate and bring the centers in line with a surface gauge; if all the centers are in line, our sketch is correct; if not in line, note how much out of line, and mark amount of offset as shown at *E*.

An eccentric, Fig. 80, furnishes an opportunity to use in its construction the parallel lines of Fig. 72, the center lines of Fig. 74, and radial dots in Fig. 75. First, draw center lines *A B* and *C D*; around their intersection as a center make six or more dots, six will do, and draw circle through them to represent the hole for axle fit.

Parallel to *C D* draw *E F*, taking intersection of *E F* with *A B* as a center, make six points around and equi-distant from it (as was done for axle fit), and through them draw circle which will represent outside diameter or strap fit; within this circle, and concentric with it, draw another to represent bottom of tongue.

Spaces at *G* and *H* are usually made to lighten the casting, their outline, it will be observed, is on the outer side concentric with the strap fit, while on inner side the line is made from center of the axle, leaving a bar at center between the two spaces.

The outlines for edge view should be projected from side view, from which lines the thickness is shown, both of the tongue and over all by parallel lines drawn to projected lines.

If we measure the eccentric from which this sketch is made we find the hole for axle fit to be 7" diameter and mark it as on sketch.

The distance between center lines *C D* and *E F* we find to be $2\frac{1}{2}''$, this being one half the distance passed through in one revolution by the center *I* of eccentric. The throw would therefore, as commonly understood, be 5 inches.

To find this throw from the eccentric, measure from outside of widest part to the hole, also from the outside of narrowest part to the hole, and the difference is the throw.

Measuring over all we find the diameter to be $14\frac{1}{2}''$, and bottom of tongue to be 14", placing these dimensions between the views as shown, we find thickness of tongue 2", and width over all 3", and place sizes where they belong as in sketch.

The keyway and set screws are next measured and sizes noted, and we have all the information necessary to build the eccentric.

When sketching from the object it is of the greatest importance that all dimensions, the radius of all curves and measures of all angles, be accurately given.

All the figures in foregoing lessons will be first-class practice for free-hand work.

At the Ft. Wayne shops of the P., Ft. W. & C. they bore a set of tire for an 8 wheeler in 4 hours. This is quick work for wheels from five to six feet in diameter. Who does it in less time?

Jenkins Bros. have recently issued a new catalogue and price list of their valves, resuming their former prices and discounts; they say that dealers did not like the low list price and low discount, so they go back to the old and higher general list.

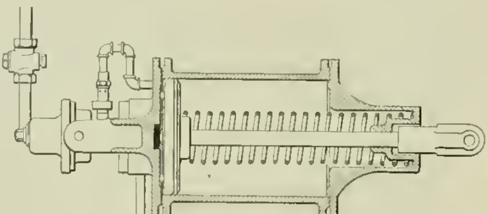


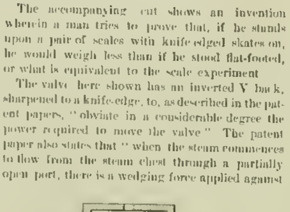
Fig. 1.

AIR-BRAKE QUICK RELEASE VALVE.

A Great (?) Invention.

The accompanying cut shows an invention wherein a man tries to prove that, if he stands upon a pair of scales with knife-edged skates on, he would weigh less than if he stood flat-footed, or what is equivalent to the scale experiment.

The valve here shown has an inverted V back, sharpened to a knife-edge, to, as described in the patent papers, "obviate in a considerable degree the power required to move the valve." The patent paper also states that "when the steam commences to flow from the steam chest through a partially open port, there is a wedging force applied against



sloping side of the V-shaped projection of the valve which tends to start it in its forward course." What the pressure on the other side of the valve would be doing at this time is not stated. It is not at all surprising that an inventor (?) can be found who would want to patent such a device—the woods are full of 'em—nor is it much more surprising that patent attorneys will push such claims through, as did Messrs. Brown Bros. in this case—there is something in it—but it is not only surprising, but deplorable, that such a ridiculous patent should issue from the office at Washington. Some years ago an English inventor corrugated the piston in a steam engine, claiming that he thereby increased the effective area of the piston and the power of the engine accordingly; but he made sharp ridges all over the piston, and according to the theory of Mr. De Groff, the inventor of this valve, he would have less pressure—as the steam would have no place to stand—as it were. Both of these inventors (?) tried to get something for nothing.

If this theory holds good, why not make a boiler of sharp seams or corrugations on the inside, then, if they were sharp enough, the steam could get no hold to push out, and, of course, the boiler could be made of lighter material—say tin.

Quick Release Valve for Automatic Air Brakes.

The Westinghouse Company have recently bought out the patent of Peter Grabler, of Allegheny, Pa., for a simple little device to hurry the release of automatic air-brakes.

His invention consists of a small valve screwed into the exhaust passage of the triple valve case, and connected at the other end, by a pipe, to the back end of the brake cylinder. Our engravings will make both its construction and location clear. Fig. 1 is a plan view of the cylinder, the triple valve case and the release valve, and its connections. Fig. 2 is a sectional view of the valve itself.

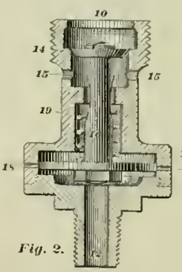


Fig. 2.

The automatic air-brake is quick in application, and the triple moves prompt and quick for release, but the air escapes through a comparatively small port in the valve, which, for obvious reasons, cannot well be enlarged, and the release is not so quick as is always desirable, although a slow release has its advantages for nice work.

With this release valve in use air is applied to the brakes as at present, and when the triple valve is moved to release the air entering, the exhaust port simply moves a piston in the release valve that opens a large passage directly from the brake cylinder to the atmosphere. In Fig. 2 there is a stem, 16, on one end of which there is a large valve, and upon the other end a small one. The large valve acts as a piston to move the small valve off its seat. The under side of the piston, 12, is connected to the exhaust passage of the triple valve; the top, 10, to a pipe direct to the brake cylinder. There are two rows of ports to the atmosphere, as shown at 18 and 15, but neither of these ports are open to the pressure in the brake until the large valve, 17, has unseated the small valve, 14.

When the brakes are applied the pressure in the cylinder tends to hold down valve 14, but when the triple moves to release, the pressure from the exhaust port flows under the piston 17, and, because of its greater area, forces it up, unseating valve 14 and opening the ports 15 direct to the brake cylinder, and ports 18 *via* the exhaust port, causing a very quick release; a light spring, 19, keeps the valves in their normal condition when the brake is released. This device can be applied to old equipment as well as new, and would, no doubt, be of use on fast suburban trains and local runs.

Roundhouse stoves look lots better in summer if whitewashed, and, when the job is a good one, do not look bad when in use. Salt used freely in the whitewash will prevent its rubbing off, and make it stand the heat better. Salt should be used in whitewash for shop walls.

The Strong engine, built some two years ago by the Schenectady Works for the A., T. & S. F. Railroad, has been lying idle at Topeka until very recently. She is now in express service.

Historical Locomotives.

THE "CAMELS."

Ross Winans' "Camel" engine marked a great advance in freight-moving power, and the reputation of these locomotives was, and still is, widespread; there is scarcely a fireman in the country who has not heard of the "camel-backs," as they are called by the rank and file. This name came from the expression, "riding on a camel's back," which, in the old days on the B. & O., meant running a "camel" engine.

Ross Winans was one of the most original and progressive of American locomotive builders, and to him is due the credit for many modern improvements, but his greatest service was in his fearlessness in putting heavy engines at work on comparatively light roads, and forcing thereby the freight-carrying trade away from the little toy engines, with which other builders and railroad officers were experimenting.

The first locomotive built in the U. S. with more than one pair of drivers was the grasshopper locomotive "York," built by Phineas Davis for the B. & O. in 1834; following this class was the "Coal Crab," like the grasshopper, except that it had horizontal cylinders.

These little engines did a great amount of work for their weight, and demonstrated the utility of coupled drivers.

Ross Winans proposed to build locomotives for the coal carrying trade, of a pattern different and heavier than any before attempted, and in 1844 turned out the first eight-wheeled connected locomotive. This engine had a horizontal tubular boiler, with a very large dome, the pistons were coupled to an intermediate shaft which was geared to the back axle, the 33" drivers being connected by side rods; this engine was named the "Buffalo," and was the first of six that became known as the "Mud Diggers"—because they pounded up mud and dust from the light superstructure.

About 1848 Baldwin commenced turning out six and eight wheeled coupled engines, in which the connections were direct to the drivers, and Winans saw the advantage of this form, and in June, 1848, turned out of his shop at Baltimore the engine "Camel," the first of that type, within the next ten years he built more than 200 of these engines, 119 for the B. & O. alone; they were used also on the P. R. R., P. & R., N. Y. & E., N. C., C. & P., and many other roads.

The breaking out of the war closed Winans' shops, and they were never permanently opened again.

The "Camel" shown in the cut was one of the last built by him, and was turned out in 1860; for this engraving we are indebted to the *Journal of the Franklin Institute* of October, 1878, and from which we quote as follows:

Among the features of novelty which distinguished the "Camel" engines from those of prior construction, may be enumerated the following:

The employment of eight driving wheels, set closely between horizontal cylinders, and a long overhung fire-box, the width of which is equal to, or greater than the width over the frames.

A fire box having a downwardly and rearwardly inclined top.

A dome and engineer's house, placed on top of the boiler, and close to the forward end.

An upper shute for feeding coal through the top of the fire box.

A fire box having no water space on its rear side, which was closed by doors so large as to expose the whole area when required.

The abandonment of crown bars, and the substitution of stay bolts connecting the crown sheet with the outer shell direct.

The half stroke cam as a means of affecting cut-off.

All these engines were of substantially the same pattern, except as to the fire-box, of which there were three classes, the short, medium and long, the latter, which is shown in the illustration, being 8 feet 6 inches in length by 4 feet wide. The grate surface of the medium class was 6x3½ feet, giving the enormous area of 21 square feet.

The boilers were of $\frac{5}{16}$ iron and 46 inches in diameter. The cylinders (except in a few early engines, which were 17") were 19"x22", and the diameter of the drivers in all cases was 48", with an extreme wheel base of only 11' 3".

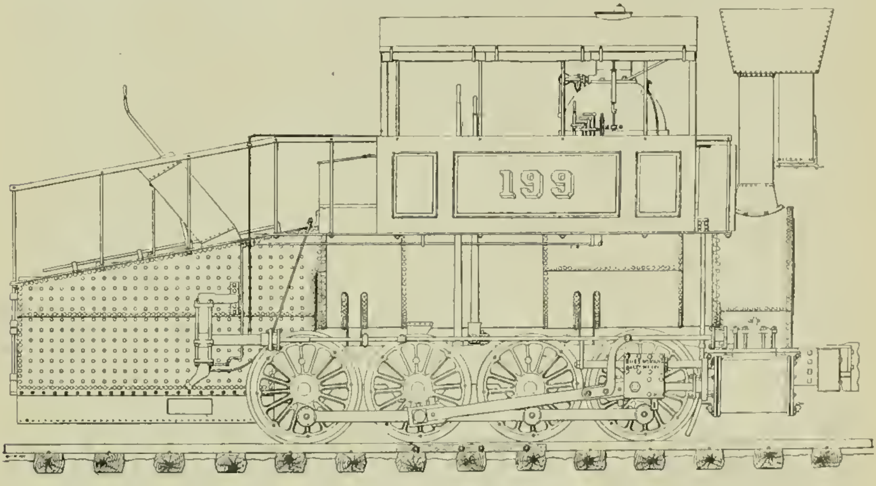
The pump was located back of the drivers, and driven from the crosshead or the main rod—as in this case—the long plunger rod running through several guides on the frame.

Double plate frames were used; these plates were something like half an inch thick, and far enough apart to have the equalizers and springs hung between the plates and out of sight. No wedges were used except on the main box, and this was in front, instead of behind.

The stack had an extension instead of the front, and such cinders as would not go through the netting found their way into the trap and could be dumped out.

The side rods had no knuckle joints, but were in three short, solid-ended pieces.

The whole back of the fire box was doors, and the front of the tender had a "pit," the deck of which was on a level with the ash-pan, and the fuel deck was almost breast high, there was a second deck on the tank just above its top and over the fireman's pit; from this deck the head brakeman was required to fill the shute shown on top of the fire-box (there were two of these in some engines); these shutes held several bushels of coal, and had a trap door at the bottom that could be opened by the lever shown at the top or the one shown on the fire-box, within reach of the fireman in the pit, so when he wanted coal ahead in that 8-foot box he pulled the lever, dumped the coal and then spread it with his fire irons.



The front and rear wheels only were flanged, and end play left in the boxes to admit of the passage of the engine around curves. Chilled cast-iron tires, were used, fastened on by hook-headed bolts passing between the center and the tire; in some of the earlier engines chilled wheels, without separate tires, were used. The weight of these engines varied from 25 to 29 tons (2,000 pounds). The valve motion was the old "drop hook" pattern, and the valves could be operated either by an eccentric or a half-stroke cam for cutting off, as desired.

In regular service these engines hauled eight loaded cars, 20 tons each, up grades of 116 feet per mile, with frequent curves of 600 feet radius, but they did, for a period of two months, perform the remarkable and probably unparalleled duty of hauling a tender and one loaded car up a grade of 1 in 10, or 528 feet to the mile, having curves of 300 feet radius, at a speed of 13 miles per hour. This was done on a temporary track laid over the Kingwood tunnel on the B. & O. road.

The "Camels" have now nearly disappeared, but there are still quite a number of them at work and doing well; as an engineer handling one in the Cumberland, Md., yard remarked: "You can't hurt one of them much, they're tough."

These engines never had any lagging or jacket on their boilers, steam chests or cylinders. The throttle lever, shown on the back of the dome, hung down and moved to and from the runner; it was dubbed the "grindstone crank," for its resemblance to that well-known handle.

In some of these engines, built years afterwards by the B. & O. road, the draw bar went through the ash-pan, but in the original ones the draught irons were secured to the frame ahead of the fire box, ran under the ash-pan, and were firmly braced to the back of the fire-box, having a short bar coupled from there to the tank.

There was a short combustion chamber ahead of the grates, the latter were cast-iron bars running lengthwise, and so hung that by putting a lever on the back end each one could be rocked sideways.

The "Camel" engines did remarkable service in their time, but were so heavy and long on such a short wheel base that they were prone to bob around at high speed, and often hunted the ditch. We may easily see that Mr. Mitchell's "Consolidation" engine of 1866 was simply the improvement and development of the "Camel", he put a pony truck ahead to steady the engine, keep it from "nosing," and swinging, and help to guide it, spread the drivers, placing one pair under the fire box, thus getting the weight distributed better, and so developing an engine that has become the recognized standard for freight service at home, as well as in several foreign countries.

Correspondence

Knowledge is Power.

Editor The Locomotive Engineer

Not long since I saw a man struck by lightning—"Jersey lightning"—and the experience was certainly interesting and amusing.

It happened at night. I was riding upon a locomotive that was hauling a fast express train, and from the beginning of the run noticed that the fireman acted in a peculiar manner and was remarkably communicative. I soon discovered that he had been imbibing the "Jersey fluid," and was feeling its effects. We had gone perhaps ten miles, when an employe left the baggage car, climbed over the tank, entered the cab, pulled a bottle from his inside pocket, and offered it to the engineer, who declined, then turning to the fireman, he said, "Try it, Jack," and Jack tried it, and put himself outside of about four fingers of the contents, and reluctantly returned the bottle to its owner, who took a long pull at it, held it before the gauge lamp to see how much remained, handed it again to the fireman and told him to finish it, which he did in a twinkling. The employe then returned to the car, and the fireman began telling me how much he knew, and how well he could handle a locomotive.

Said he, "I'm different from other people, I can take a drink, and it don't make a fool of me. I always know twice as much when I get a drink in me and I can make the 'old gal' steam red-hot all the way over the road. Say, I know twice as much now since I had that drink, just watch the pointer of that gauge waltz around towards Boston, you'll hear the old scald pot pop in a minute; there she goes," and he opened the furnace door, and dropped in a few scoops of coal. "Say, the old man's pulling her for all she's worth, but he can't make her sour on me to-night. I know too much, I know three times as much about a locomotive when I get a nip or two. It don't make a fool of me like it does of some people. We've struck the hill now, and the old man is dropping her down; he can pound her to-night, but she'll have the fog all the same, let me get outside of a snifter of old rye, and I can keep the putty on the worst old iron heap the company owns; there, she's poppin' again. Crack it at her, old man, we're over the hill now, and she's doing her mile. Say, do you know a drink of whiskey makes a fool of some people. Yes, sir, makes the biggest kind of a fool of 'em, but it don't affect me that way."

His tongue wagged incessantly during the whole trip and the last thing I heard as I left the engine was, "Say, I know twice," and I was out of hearing. BAX

Elizabeth, N. J.

[The writer of the above, who is an engineer with a record for veracity, assures us he has reported the case *verbatim*, and that the fireman who knows how to be twice as smart has since been promoted.]

A Plea for Automatic Steam Valves.

Editor The Locomotive Engineer:

On the 19th inst. an Old Colony R. R. passenger train, known as the "limited," from Woods Holl, was derailed near Quincy, Mass. Twenty-one persons were killed, and some forty others injured. The Boston *Herald* of Aug. 20th credits General Manager Kendrick, of the Old Colony, with the following statement: "It was here," wrecked car No. 263, "that all the fatalities occurred, as I am informed—either from the shock itself, or from the escaping steam, which arose from the broken pipes of the engine."

This last brings forcibly to mind the advisability of using a flap valve inside the boiler in connection with the check valve, so that should the latter be broken in an accident, the flap valve will be closed by the pressure within the boiler, and thereby prevent the escape of steam and scalding water through the broken check valve.

I do not wish to be understood as blaming the mechanical officers of the Old Colony R. R. for not using this valve on their locomotives, for it is possible that the wrecked engine was so equipped, but I wish to call the attention of your readers to a simple and cheap device, which may be the means of averting a severe scalding accident.

Narragansett Pier, R. I. EDW. L. FOSTER.

Cure for an Engine that Slipped Shut Off.

Editor The Locomotive Engineer:

In reply to Mr. Arnold, would say that the side rods on engine 121 are solid rods, and are lighter than her old strap rods by 25 lbs. each.

E. A. G. wants to know what we mean by, or rather how the word slipping should be construed. What I meant by engine 121 slipping was this, when running along, say, 25 miles per hour, her driving wheels would slip ahead as fast as if she was running 50 miles per hour without slipping.

This engine came out of the shop about two months ago, with new driving axles in the same wheels she always had. She don't slip any more. We have had several engines on the N. Y. Central that acted the same as the 121, and in each case the axles were twisted, and by putting in new axles the slipping was cured. I wonder if the cramping or springing of side rods, while passing the center, would have a tendency to cause slipping?—Hardly.

Syracuse, N. Y. W. F. RELYEN.

Flat Spots on the Tire—Why Always in One Place?

Editor The Locomotive Engineer:

I am firing on a road that runs along the Mississippi River. We have fifteen sixty-five ton ten-wheel engines of the Rhode Island make, also thirty eight-wheeled standards of the same make, twelve of which have a larger wheel for passenger service. The road is level, but very crooked. Engines pull from thirty-five to fifty loads. Those engines, with very few exceptions, pound out a flat spot in their left forward driving wheel tires just as she passes her forward center. As soon as the flat spot begins to appear they change it half way around, and after a time another flat spot appears in the same place. Can you tell us why those engines pound out a flat spot on her left forward drive wheel and on no other wheel? Passenger engines being the same. C. B. NORTH.

Galena, Ill.

[This is the second letter we have had from the same source and on the same subject. If the reports are true we cannot account for the flattening action. Some engines slip slightly when working hard, when both main pins are below the axle, but this wears the tires alike. It often happens that when the center of an engine truck is out it will throw more weight upon one side than the other, and in case of excessive slip the wheel bearing the heaviest load would wear the most—but not in spots. If this trouble is the same with a large number of locomotives of one build it seems strange that no complaints have been filed with the builders. Give us all the particulars—what do the motive power officials of the road say about it?]

How to Make Lubricators Work—Tallow vs. Cylinder Oil.

Editor The Locomotive Engineer:

I have been a subscriber of your paper for some time, and am frank to state that I consider it one of the very best of its kind.

I have just finished reading the August number, and wish to say a few words about "Old Mossback," and his faith in the "good old tallow and old-fashioned tallow pipes."

I presume he would not object to the still older arrangement—the cup on the steam chest—but I fear the fire boys would kick at this day if they were required to climb out to put a little tallow in the cylinder, as of old.

As to sight-feed lubricators cross-feeding, I believe the Detroit cup has been often charged with this fault. However, I have run an engine with the Detroit cup for about one year, and in that time I never detected it cross feeding, but have heard other men on the road say they have.

I am at the present time running an 18x24 Baldwin engine on fast passenger with a Nathan cup. We use nothing but cylinder oil, and I make 212 miles with a cup of oil, over a level road, and do local work. The valves on our engines are not, as a general rule, even scratched when they go into the shops after making from 40,000 to 60,000 miles.

Some twelve years ago on another road the M. M. introduced cylinder oil, and told the boys it must take the place of the "good old tallow." They kicked, and said they would not be responsible for their engines. The M. M. told us that cylinder oil had to have a fair show. There were no valves nor cylinders cut, and we heard nothing further about it. It is in use to-day on that same road, giving the best of satisfaction.

When cylinder oil was introduced on the road I am on at present, a howl went up from the boys, but my advice to them was to give it a fair show, as I had been there before.

I consider cylinder oil just as good as tallow as a lubricator, and it will not eat out steam chests and cylinders like the "good old-fashioned tallow."

If "Old Mossback" will give the sight-feed cups and cylinder oil a fair show, and decide on their use by their record in service, he will soon have to bury his prejudice and become a convert to all these "new-fangled rigs." J. L. ANDERSON,

Florence, S. C. Engr. Atlantic Coast Line.

About Big Engines.

Editor The Locomotive Engineer:

Old Timer is after me about the big engines, and I am surprised that he waited over a month—been sort of expecting him. All I have to say is that, where big engines have been introduced slowly, and the service cheapened to the company, the freight agents have cut the rates, and in consequence secured more tonnage, and therefore needed more engines and more men to move it. I don't believe there is a road in the country that does not now employ as many engineers as it ever did, yet 80 per cent. of them have adopted big freight engines within the past ten years. Whenever you do the same work for less outlay, or more work for the same outlay, there will be a cheapening of service to the public, and an increase in the volume of business. This is proven in the history of every industry in the country, except where the cost to the public has not been reduced, because of some false guard—such as a high tariff. That big engines temporarily cut down the number of enginemen, if introduced in large numbers, I do not dispute, because so much work is done before rates can equalize, and an increase of traffic occur.

We have a case of that on our road now, probably the biggest case of the kind on record. The N. Y. C. & H. R. R. have always stuck to the 8-wheeler for freight service—and not very heavy ones at that—the officers, as well as the men, declaring that they would pull as much, and run on less expense than Moguls, Consolidations, or any other class of large locomotives doing service elsewhere. About two years ago they made a trial of a 6-wheeled connected engine, and found that they could haul more cars, and consequently make more money with them. Then, instead of replacing old engines with larger ones, and letting them work in gradually, as other roads have done, they bought them of several works in batches of fifty or so, and put them to work as fast as received. The result was that it cut down the number of trainmen and enginemen, and there was a row at once. Trace the strike this month on our road to its origin, and you will find it right here.

We ought to have had heavy engines ten years ago, and long before this the road would be handling as many trains as now, and using as many of the big engines as they are now using of the small. Suppose, however, that big engines do retire enginemen, what are we going to do about it? Can we ask the roads to keep the small engines in service at a loss, to employ more men? Why not ask them to adopt engines of the "Rocket" pattern, that could probably pull four cars? That would increase the number of enginemen ten to one.

Brothers, these things will equalize, if given a little time, the number of enginemen in service in America is steadily on the increase, and—let me prophesy a little—will continue to increase in numbers during the next decade, as they have in the past, and the size of the engines they run will not affect their numbers in the end, at least, that is the opinion of an engineer "what ain't afraid," who signs his name W. E. ANDROS.

Albany, N. Y.

John Alexander's Advice to Young Runners—None Genuine without the Signature—Shake Well Before Taking.

Editor The Locomotive Engineer:

My boy Fred has been promoted—real, live, made-a-purpose engineer, now.

I am glad of it, and as proud of him as David was of Absalom, and yet there is a sort of lingering, sneaking regret about it somehow, just as there is when you suddenly realize that your children are no longer children, but men and women; just as there is when a parent sees a loved daughter marry the man of her choice, and the one she wants—we feel as if the new responsibilities might call for qualifications not in stock—a dread.

Fred has fired long enough to know his business, and I think he does know it, but, like all the rest of us, he will realize now what responsibility is; that firing is principally physical exertion—with a little figuring, and thought, and care around the edge, and that running is principally care and thought and figuring, just seasoned with enough labor to make it interesting. A man that don't realize what grave responsibilities he assumes when he takes charge of a locomotive had ought to be employed on a sheep ranch—not a railroad.

Fred has been asking me for a little advice—curious thing for a young runner to do, too, but Fred always was odd. I was just thinking that of all the young men who read the L. E., and who are striving for promotion, Fred is, perhaps, the only one who can go to a father for advice, and have that father the greatest living engineer on earth—I would have told you this a long while ago, except for my natural modesty.

I've been telling Fred a few things, and pointing to a few shoals, and if any of your readers want to get the benefit of the lecture let 'em crawl under the tent and listen.

Sais I to Fred, sais I:

Don't treat because you have been promoted—wait to see if you can hold the job down.

Look over the engine you are going to take out, but don't touch a bolt or a key until you have run her, and are sure you know what she needs and will stand.

Be careful to see that she has all tools and supplies.

If she has a regular fireman tell him that it is your first trip, and that you want him to give you all the pointers he can about the engine and the run, don't assume that you are made of different material, or know more about all railroad and locomotive work than he does—very likely you don't—enlist and interest him in your success.

Say to the conductor "Charlie, this is my first trip, and I may be paying more attention to this old mill than to the time-card; don't let me make any breaks." He will help keep you straight, and will give you credit among the other men for not knowing too much—a fatal railroad fault.

Look out carefully for the time-card, sacrifice almost anything but safety to keep on time and make your meeting points—this is really the essential qualification, and will give you a reputation for efficiency in the trainmasters' office, and the dispatchers will rise up and call you blessed, and cut down your layouts to the minimum.

Remember that the first law of railroading is "protection"—keep out of everything on wheels, and keep everything on wheels out of you.

Make a cast-iron rule that you will never drink on duty, and mighty seldom off, and that no man, yourself included, shall sleep on your engine while in motion.

Do your work cheerfully, if the trainmaster asks you to haul twenty cars more than a full train, spit on your hands and pull at 'em with a smile—tell him you can't do it *after* you have tried rather than before.

Always give your orders to the fireman to read—he may help you.

Now, about the engine. The ideal locomotive engineer is the man that has his engine in such condition that he can run her without looking at her or thinking about her, but can look at the road and think about the time card and the orders.

Let the builders *make* locomotives, and the shop men *repair* 'em—you *use* them.

Keep every stuffing-box neatly packed, and the headlight clean—that is your work.

Don't change the eccentrics or tile rod brasses—that is not your work—it is a mighty good man that does his own work.

When you get an engine regular fix all her oil-boxes and cups so that she will keep cool with as little waste of oil as possible, and try to run a long distance between oilings; don't have towns where you oil anyway, and others where you don't—oil the engine, not the town. Fix your front end so that the engine steams well, and then keep out of it—you don't keep on taking medicine after you are well.

Wedges should be set up about right, and securely fastened, then left alone for at least six months.

Key your side rods solid, brass and brass, and so that they are free on the pins, and then let them alone until you change your wedges—never key them up snug when the rest of the engine can come and go through wear—that kind of care is what sends them through the cab.

Keep both ends of your main rod keyed up fairly well, and have the crosshead lined up when you can put a piece of tin between it and the guides near the *ends* of the guides—not the middle.

When wedges are set right, rods keyed and securely fastened, eccentrics keyed, and all the bolts in the motion work fast, and the nuts keyed on, don't touch anything but the handles in the cab—it is the man that *works* on his engine that has the hot pins and cut brasses.

I could preach you a whole sermon, my son, on this little text alone. Work till you get them in pretty good shape, then consider that they have suddenly become sacred—and don't touch them. Don't try to get them just perfect—you can't.

Report work carefully, and not until you know it ought to be done; study your engine, and don't have jobs done a few months before she goes to the back shop that could be made to do until she did go there.

It is not the sign of a good engineer to book work every trip; the best ones have the least work to do.

If you want to make a record for economy in fuel look to all the little causes of waste; remember that the pop is throwing away coal instead of steam, that you can save a lot by careful pumping, and careful firing—don't get after the nozzles, the valve gear, or the valves, until you have looked up every motion of the fireman and yourself from the time the coal is piled upon the tender until it leaves the stack.

Engineers are the brains and nerves of the locomotives, and the locomotives pull cars over the road, thus earning every cent a railroad takes in, so you see that on your judgment, and reason, and ability depends the success of the road—try to be the best engineer on the line.

The best engineer is the man who pulls the most freight the nearest on time, with the least expenditure of fuel, oil, or for repairs, and the least damage to his train.

Keep away from the offices, do your work with the least fuss and smoke, have few kicks coming, and few favors to ask, and you will be more successful when you do kick or ask a favor.

Do not kick at every change that is made on the road, or on the engines—reforms can only come through a change—give every plan and every device a fair trial, and your verdict on its merits alone. Locomotives are far handier, safer and better than they were when first I tackled one, yet the engineers have kicked against every improvement that has been introduced in the past thirty years—I say it to their shame.

When the air-brake was first introduced the old-timers howled and squirmed, and I am ashamed to say that I once refused to run an engine because she had solid-ended rods—I wouldn't have any other kind now, if I could help it.

Defend your rights, but don't forget that every one has just as many as you have.

Keep your life insured and your board paid—you can never tell when something will get on the right of way, and put the 211 in the ditch and the great extinguisher upon your light—be ready for it.

Study your business, be a thinker—lead, don't follow. Save a little money as you go along, and, maybe, when you are old, like me, you won't have to run a mail train that leaves at 11.10 P. M., but can keep a cigar stand or own a sponge foundry of your own.

If you don't meet anything on the main line I may tell you something more next trip.

Boston, Mass. JOHN ALEXANDER.

Explanations are in Order—A Reverse Lever Question.

Editor The Locomotive Engineer:

We use in freight service here 20x24 consolidation engines with 48" wheel. There is something about these engines I don't quite understand, and I would like to have the opinion of your many intelligent correspondents in regard to it. When these engines are rolling down hill without steam, say twenty-five or thirty miles an hour, and the reverse lever is let down anywhere in the neighborhood of the corner, or even two-thirds of the way down, the reverse lever and running gear jar terribly and kick up such a racket that one would think everything was being torn to pieces. And it takes a full-grown man to pull the lever back towards the center again. The consequence is that a majority of our men don't let the reverse lever down when rolling down hill without steam, and, of course, this is detrimental to valve seats, as it wears them only in one place. Now I would like to find out the cause of this jarring. The engines are all new and in first-rate order, and use Allen-Richardson balanced valves, and large relief valves on steam chests.

They are Baldwin and Schenectady, first-class builders. I have thought about this matter a good deal and have not come to any satisfactory conclusion. I have also asked a good many experienced men about it, and have never received any very definite answer. The faster these engines run without steam the greater the jarring is. Hope I will get some information about this. "TAR HEEL."

Greensboro, N. C.

[We have heard this complaint from several sources, mostly from 10-wheelers having an intermediate connecting bar from the link to the rocker, in order to avoid the front axle. The writer has had experience of the same kind from engines of this class. We wish all who have had experience with engines affected in this way, and especially if they have found the cause or a remedy, would let us know about it. The trouble is so serious in some cases as to make it impossible to get the lever out of the corner at high speed.]

The Haberkorn Triple Valve in Service Stops.

Editor The Locomotive Engineer:

I was interested in reading the article in August number on the Haberkorn brake, but would like an explanation of one point in the operation of the triple valve. When a slight reduction of pressure is made to set the brake lightly, the triple valve piston, 2, will move down until exhaust valve, 3, seats, and will then stop. The pressure from drum will then pass around graduating stem to brake cylinder and set the brake, and will continue to set harder until the pressure in brake cylinder is equal to that in drum, and brake is fully applied, or the flow is stopped by releasing brakes.

It seems evident that the triple valve piston will never stop between the position where valve 3 seats and the full emergency position shown in cut. If my reasoning is correct, this brake when once set would continue to go on tighter until it was applied with full force or released, and would work just as the brakes do that are sometimes met with, which, owing to leaks in trains, set themselves continuously harder as soon as the air is applied at all. We all know how vexatious this is, especially in holding a train down a long hill. Perhaps I have overlooked some point in the operation, but this seems to me a serious defect. WM. BOHANNAN.

Argentine, Kan.

[The graduating stem, or plug, between the shoulders 1 and 2, is supposed to close the passage when the end of the stem touches lever 4 to exhaust valve. If it does this the valve will hold the brake on all right in service stops, if it leaks the brake will creep on.]

The Vacuum Automatic Brake as Used in England.

Editor The Locomotive Engineer:

I have been much interested in the articles published from time to time in your journal on the subject of automatic brakes, and have wished that we had here in England a similar paper devoted to teaching drivers, stokers and fitters how to repair and handle brakes and other locomotive devices.

The Westinghouse atmospheric brake has pretty much of a monopoly in your country, if I understand it, and the only trouble is to get the men to understand it, but here it is different; we have no less than four different systems of automatic brakes, good and bad, and the rolling stock being exchanged, it is often that we find two and three kinds of brakes in a train, and, of course, can use very little if any of it. All accidents in this country are investigated by the Board of Trade, a government committee, and they have laid down five rules, called the "Board of Trade conditions," that a brake must fulfill to be deemed a safe and proper brake; but I am sorry to say that the chairmen of many of our lines pay no attention to them at all.

These "conditions" are as follows:

1. The brakes to be efficient in stopping trains, instantaneous in their action, and capable of being applied without difficulty by engine drivers or guards.

2. In case of accident to be instantaneously self-acting.

3. The brakes to be put on and taken off (with facility) on the engine and every vehicle of a train.

4. Brakes to be regularly used in daily working.

5. The materials employed to be of durable character, so as to be easily maintained and kept in order.

England is indebted to the United States for the invention of the automatic air-brake and the simple vacuum brake, but our own inventors have given us two or three kinds of automatic vacuums that are, I am told, unknown in your great country.

Here it makes all the difference in the world whether you say "vacuum automatic," or "automatic vacuum." This last brake is known as the "leak-off," because, after being applied, it automatically leaks off in about two minutes, and is a very dangerous brake, as you can well see. The "vacuum automatic" does all that the automatic air brake does, it is in very extended use here, and I will try to explain it to you—faults and all.

I guess all American enginemen know that the simple vacuum brake, as invented by Mr. Smith, is worked by the pressure of the air on diaphragms or cylinders, from which the air has been drawn out by a jet of steam.

Mr. Smith brought his brake to England in 1874 and it took at once; it was cheap, quick, had no moving parts on the engine, required no oil, and very little attention; but it was non-automatic, and therefore dangerous; our inventors made it automatic. I have traced some cuts of the principal parts from a book recently published here on the subject of "Safe Railway Working," and think by their aid I can make the brake plain to your readers.

In the first place, they still use the large annular jet of steam to produce a vacuum in the train pipe, but this holds the brake *off* instead of *on*, as in the Smith vacuum, then, after producing the vacuum, they shut off the big ejector and use a little one to keep the vacuum up against leaks. Fig. 1 is the engineer's valve; it is placed on the side of the boiler just as shown, and the handle works up and down instead of to and from you, as in the Westinghouse.

When the driver puts the handle at "off" the big ejector quickly produces a vacuum and releases the brake, then he moves it to "running position," and the big ejector is shut off, and the little one, shown in the center of the big one, is put to work, the gauge telling how much vacuum is maintained; when it is desired to apply the brakes the handle is moved to "on," and air is admitted through the many perforations shown in the body of the valve, and the brake is applied.

Now let us see how it does this. Fig. 2 shows the brake cylinder and auxiliary drum, or what takes their places; the outside shell is large and hung under the car vertically on the two trunnions shown, so as not to cramp the piston rod, which is

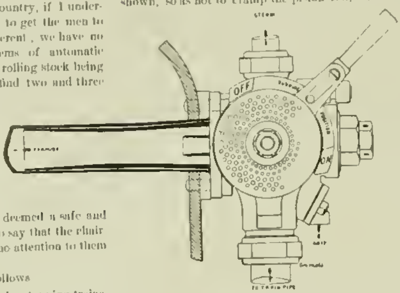


Fig. 1.

attached by levers to the brake gear, the train pipe is connected by a short piece of hose. Inside of this drum there is a cylinder, open at the upper end, and in this cylinder a piston with a shell head, as shown, around this piston head there is a round rubber ring—like a bicycle tire—that rolls between the piston head and the cylinder, forming a tight joint with very little friction; in the cut it is shown at the top. At the bottom of the drum there is a valve case with an opening from above and below the piston, and in this valve case lays loosely a rubber ball; this ball valve is shown in detail in Fig. 3. Now, when a vacuum is created in the train pipe the air is taken out from under the piston and from above it, the ball valve having

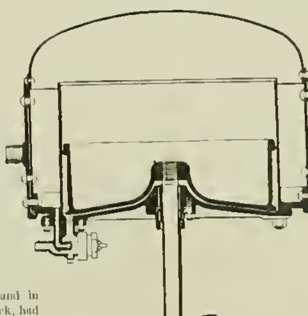


Fig 2.

no tendency to move in any way, and so, when running, the brake piston lays at the bottom from its own weight, but let air be admitted to the train line and it pushes the light rubber ball ahead of it, and against the seat where it is shown; this prevents the air from going above the piston and admits it freely below it, raising it at once and applying the brakes, which can be taken off only by restoring the vacuum.

Fig. 3 shows the ball valve; this ball is enclosed in a brass cage, the cage being movable in the case, and prevented from leaking by the diaphragm shown by black lines; this case is connected to a rod outside, and by pulling the cage out the ball is pulled away from its seat and air is admitted above the piston, releasing the brake; this answers the same purpose as the means for "bleeding off" the airbrakes.

Fig. 4 shows the guard's valve; this is located in the guard's van and answers two purposes, affording the guard opportunity to apply the brake and aiding the driver in making an emergency stop. Just above the valve there is an enlarged chamber to which the guard's vacuum gauge is attached; this chamber is connected to the train pipe by a small hole drilled through the valve spindle as shown, the top being kept from the air by a disk nearly as large as the valve; the valve seats down on edge of case, and around the case, above it, are numerous holes; now when a vacuum is produced in the pipe the air holds the valve down, and the chamber above the valve contains the same vacuum as the pipe, but should air be admitted suddenly to the train pipe it destroys the equilibrium between the top and bottom of the valve, and it is lifted from its seat, admitting air direct to the train line through the perforations. If the guard wishes to set the brake he does so by lifting the valve by means of the lever shown.

The vacuum automatic is a good brake, very quick, both as to application and release, thoroughly automatic, has few moving parts, is easy to keep up, and is cheap, but it has one fault—the little ball valve sometimes freezes to its cage through moisture being admitted to the pipes in the air, the worst of this is that the driver and guard can have no notice of it; the vacuum gauges showing all right; you admit air to the pipe to apply brakes, and it goes over as well as under the piston, and you overrun your station and perhaps hit another train. But I have had air pipes on the air-brake freeze up on me as well. If this explanation of our vacuum automatic proves of interest to my American brothers of the foot-plate I shall be repaid. I have a great respect for your American engineers, having made many good friends among them during two years of engine driving on the Grand Trunk of Canada some years ago.

Swindon, Eng. BENJ. HOWARTH.

The Vacuum Brake.

Editor The Locomotive Engineer:

Briefly replying to one query of "Old Timer" in your August number, as to "How the automatic vacuum brake works," would say that two ejectors are used on locomotive, called the large and small ejector respectively. The large one is of about the same size as that used with the non-automatic brake, while the small one discharges a $^5/_8$ steam jet and maintains vacuum through train while running. The car equipment consists of the usual diaphragm and connections, and when brakes are off a vacuum is maintained on both sides of diaphragm. Additional vacuum space is furnished by a reservoir similar to the "Auxiliary" of the Westinghouse system. This reservoir is piped to one side of diaphragm, viz., that side toward which diaphragm moves in applying brakes. The connection between *that* side of diaphragm and the *train line* contains a check valve, while from the opposite side of diaphragm a free pipe is run to train line.

The action is as follows: When a vacuum is produced in train pipe, air is drawn from both sides of diaphragm and a vacuum of course maintained on both sides. If air be admitted to train pipe, either through engineer's valve, or by bursting of hose, it passes to one side of diaphragm, but is prevented from reaching the other side by check valve above referred to. The brakes are thus applied and are held on until a vacuum is again produced by the ejectors, train line being intact. The engineer's valve has four positions: The "Release" by which the large ejector is opened and connected to train pipe; the "Running," in which the small ejector is to put train line and maintains vacuum therein, and on both sides of diaphragms, as described, blowing continuously, a "lap" next beyond the "running" position, and lastly, the "application" port, by which air is admitted to train line to apply brakes.

Without going into details of construction, this is a brief description of the automatic vacuum brake as manufactured by the Eames Co.

New York. C. H. W.

Some Practical Points on Valve Setting

Editor The Locomotive Engineer:

The following remarks on valve setting are not intended to teach experts any new kinks (nor any one n ten-minute rule), but to teach beginners a short and quick method as can be practiced with any degree of satisfaction. We will suppose our engine's upper and lower rocker arms are the same length, and that you, or our beginners, know how to get an engine on the dead center.

To beginners it is better to have steam-chest lids off than to depend on the tram on the valve stem alone. Put engine on front center, with reverse lever in full forward gear, and with a pencil make a note of how your valve is. If it covers the forward steam port, find how much, and make your memorandum this way: "Forward gear, front end, $\frac{1}{4}$" blind," or, if the port is open a $\frac{1}{4}$" say, "Forward gear, front end, $\frac{1}{4}$" lead." Now put your reverse lever in back gear, pull, with all your strength, the valve stem toward front of engine (which will take up the lost motion occasioned by moving reverse lever), then make a memorandum of position of valve now, but say, "Back gear, front end, blind so much, or so much lead."

Now turn engine to back dead center, note position of valve, and you have the back gear ready for adjustment. Put reverse lever ahead, pull the valve stem backwards this time (to take up lost motion). Note position of valve again, this time for forward gear, back end. You are now ready to look at your paper and tell just what alterations to make in either the forward or the back gear of this side of the engine.

Say you find forward gear, front end, $\frac{1}{4}$" blind, and forward gear, back end, $\frac{3}{8}$" lead. Now, as you want her to have $\frac{1}{16}$" lead, at both ends of the cylinder, it takes $\frac{1}{8}$" total lead to give her proper lead. You see you must subtract the distance she is blind from the lead, and must have $\frac{1}{8}$" left, which you have, exactly, in this case, and it follows that your eccentric is exactly right, but the rod is wrong. Now you ask, Which way wrong? Think a minute, and you will see that it is $\frac{1}{4}$" short. Make it a $\frac{1}{4}$" longer and your forward gear is exactly right.

But suppose the back gear memorandum shows $\frac{1}{8}$" lead front end, and $\frac{1}{4}$" lead at back end cylinder, you have a total lead of $\frac{3}{8}$", which is $\frac{1}{4}$" more than you want, and you know your eccentric has slipped at once, and the blade, or rod, is not the right length, either, as she did not have the same lead at both ends. The first thing to do is to lengthen the back motion eccentric rod $\frac{1}{16}$", and then roll your eccentric backwards enough to reduce the lead at either end to $\frac{1}{16}$" and the back gear is finished. But suppose you find that on the other side forward gear shows $\frac{1}{4}$" blind for both front and back ends cylinder (which is the most common derangement). You know, by both being the same, that your rod is the right length, and that nothing needs doing but to set the eccentric, which you must move or roll forward enough to slide the valve $\frac{5}{16}$", which will give you the $\frac{1}{16}$" lead equal at each end. If the back motion shows just the reverse, or has equal lead but more than is needed, you know you only have to roll your eccentric back to reduce the lead to $\frac{1}{16}$.

The four examples cited above are the only ways that the eccentric or eccentric rod can affect the exhaust of an engine, and if, after setting her valves according to the above, she does not exhaust right, you may know that the rocker arms, or shaft, are sprung, or the link hangers are not the right length, or improperly hung. I will have something to say about the effect such derangements would have some time in the future. S. PARKER, M. M.

Plymouth, N. C.

[The foregoing article teaches a valuable lesson in showing the beginner where to look for derangement of the link motion, and what causes the different derangements. Many men who ought to know better will tinker with eccentric blades to increase or reduce lead, which can only be effected by the eccentric; and again, they will attempt to manipulate the eccentric to make the valve travel equally each side of the center of the seat, while this can be done only by adjusting the length of the eccentric blade or rod.]

Some Good Cleaning Receipts.

Editor The Locomotive Engineer.

Regarding the cleaning and scouring of a locomotive, I agree with "Petaconsett" in July number of THE LOCOMOTIVE ENGINEER; namely, that "the easiest way is the best." But with thirteen years of diverse experience as a fireman and machinist on different roads and all classes of engines, I differ with him in the art of cleaning. A dozen years ago engines were emblazoned with brass and copper fixtures, etc. All this brass work was supposed to be kept polished, for the engine was built for a thing of beauty, an ornament, as well as for usefulness. The master mechanic generally would pride himself then on the beauty of his engines. This cleaning and scouring was all done by the man who had handled tons of coal, or "heaved" cords of wood

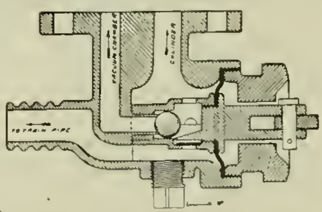


Fig. 3.

for his day's labor, and without pay for it. To-day, however, the locomotive is not built for an ornament; master mechanics and superintendents of motive power have done away with brass work and ornamentality. A new idea has established itself in our mechanical world, and that is, that it does not require an engine bronzed and polished to perform its work, and that this ornamentality is not only useless, but a detriment to true economy as well; mileage, power and economy are what engines are built for at present, our officials have a more liberal view regarding the work of firemen. They look more to the economy of fuel and material in general, and at the same time a moderate degree

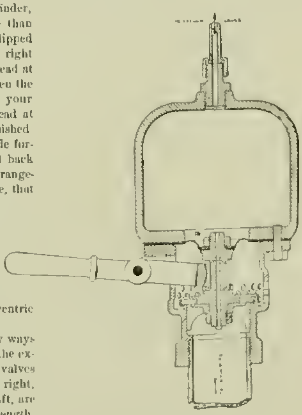


Fig. 4.

of cleanliness. I find the easiest, quickest and best way of keeping a neat engine, as follows.

The brass work is left alone in its original color, this can be easily accomplished by first removing all oil and dirt stains, and then giving it a light coat of colorless varnish, then, by wiping it with a piece of cotton waste at the beginning of each trip, the brass, hot and cold, will retain a comely and cleanly color for months without polishing; acids such as are used will eventually harden brass, and not only that, it will form a corrosive matter in "joints" and threads, thus weakening, more or less, the metal.

Boiled oil, Japan, drop black and black varnish, are used throughout the land, but the labor of keeping a "front end" or smoke-arch in good condition with these ingredients is unceasing; through gumming, scaling, etc. Smooth the front end down with emery paper, and then give it a coat of plumbago or stove polish; this will make a smooth and lasting polish and a neat and pretty background for the painted number plate and headlight.

On all paint work, inside of cab and out, I use a solution of turpentine and boiled oil, equal parts. This will take away all dirt and maintain the gloss on the paint, while the lye and acids of soap aid in deadening it. For jacket, I use a thin dope of tripoli and kerosene. This will give the iron a sky-blue color, and if the jacket is blackened and gummed through former neglect, a bucket of water with concentrated lye dissolved in it will remove the dirt, then followed with the dope. I do not think the use of cold water on a hot boiler head, to remove scale, practical, for obvious reasons. Tallow is not a cleanly article to use, as it gums and creates a bad odor in the cab. Using a sharp scraper or chisel, and then smoothing it with emery paper, is the best way to remove the dirt; to polish it use common beeswax; this will give the boiler head a pretty color without unpleasant odor. With these inexpensive articles of cleaning you need never be ashamed of having your traveling engineer or master mechanic ride with you. MANITAU.

Creston, Iowa.

Will Go to See One.

Editor The Locomotive Engineer:

I have been reading so many articles in your paper on the cause of locomotive engines slipping their wheels while steam is shut off, and there have been many reasons given for it up to date, but it appears to me that it would be quite a good idea for some one who has *that kind* of an engine to notify some "skeptic" like the writer and let him go and see the *thing done*, and by so doing one might be able to see "the why" of it. It is useless to look for a remedy for any *cause* that does not exist. The writer would put himself to considerable trouble to be allowed to ride on one of the above engines, as it is now, it makes one feel as though he had fooled away the most of his life without seeing anything of much account.

Who and where is the man that has that kind of an engine? Now, don't too many speak at once, for it would be apt to get one "rattled." It appears to me that if this thing can be worked out in the right shape, it will make Mr Keeley, with his world-wide famed motor, "hustle." Awaiting the many replies, I am,

Germantown, Pa. HOGBACKER.

Lubricators Connected Direct to Steam Pipe.

Editor The Locomotive Engineer:

I am overhauling a locomotive, and I propose to put a single pipe through the steam dome into the dry pipe to lubricate valves and pistons, instead of running a pipe to each steam chest under the jacket, and to this single pipe attach a sight-feed lubricator. Will it lubricate the valves as well as the two pipes attached to top of steam chests, as is in common use? If not, why not? Would like your opinion or the experience of any engineer that has tried it.

ALLEN WOOD, M. M.

St. Augustine, Fla.

[Lubricators connected direct to the steam pipe of a locomotive work as well, if not better than those connected to the chests when the engine is working steam; the trouble has been to get them to oil the valves properly when running down hill shut off.]

Our correspondent W. E. Andros gives a clue to the possible cause of dissatisfaction that led to the strike on the N. Y. Central. He ought to know what he is talking about—he was on the ground.

Again we must notify correspondents that we cannot use anonymous communications; don't send them without your name.

LOCOMOTIVE ENGINEER.

THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN, LOCOMOTIVE MAINTENANCE AND REPAIRS.

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS

Reason in All Things.

The news of a strike on the New York Central Railroad was a surprise to most people, not only on account of the suddenness with which it took place, but because it has been thought that the relations existing between this road and its employes were exceptionally pleasant, and, indeed, such as to make a strike almost an impossibility.

And it will seem to most people who calmly view the situation that this is a strike which it would have been easy to avoid, and which would probably have been avoided if those in authority had been mindful of their obligation to the public, and had exercised a little tact, and been a little more disposed to consider the fact that there are usually two sides to a question.

In the old times when communication between different towns and different parts of the country was by vehicles drawn by horses upon roads which all could use upon equal terms, no falling out which could possibly occur between an employer and his men could prove very serious to the general public, both for the reason that the public in those days depended much less upon travel and carrying traffic than we, and the means for using the highways were in the possession of the people generally, so that almost any one could make full and efficient use of them.

In these times, with our much more highly developed social organism, this has all been changed. The principal highways upon which we now depend for getting about from place to place, and for the transportation of food, etc., are not the simple affairs of former years, but complicated systems of railways which only those can use who have by experience and training acquired the necessary skill. And even if the skill, and all else required for the operation of these roads, were in the possession of the people, no one except the owners of them would have the right to operate them, so that when these owners fail to keep them in operation the public must get along without the highway as best it may.

And when such a system as the New York Central road becomes suddenly paralyzed, even for a short time, it is a very serious matter. The people having given to a corporation the exclusive right to occupy and use a continuous strip of land for the purposes of a highway, have a right to demand, it seems to us, that that highway shall be kept open, and in an efficient condition for service, so long as by any practicable means it can be so kept open. And it seems to us that just here the management of this road has failed entirely in its duty to the people. The immediate cause of this strike seems to have been, and most likely was, the refusal of third Vice-President Webb to receive and talk over the matters in dispute with a man who was the accredited representative of employes, who, whether rightly so or not, evidently believed that they had a grievance which should be adjusted. It was the plain duty of Webb to the company he represented, to the men, and, above all, to the public, to receive this man, talk matters over with him, and adjust the difficulties if possible. It made no difference that this man was not an employe of the road, nor that he was an officer in an organization not approved of by Mr. Webb; he was the accredited representative of the dissatisfied employes, and should have been received as such, and the questions in dispute settled solely upon their merits, if possible.

Some of the demands said to have been made by the men we do not consider to be fair. For instance, what is called the seniority rule, by which promotions are made in the service solely upon the ground of the length of time an employe has been in the service. We think this is demoralizing and unfair to men who are willing to take pains to study and improve in their business. It is simply putting a premium upon inefficiency, and is, so far as we can see, wholly wrong. Then the demand said to have been made, that when men were to be laid off it should be always the men last employed, we also think is wrong. If this rule were strictly enforced, what chance would a railroad company have to improve its service, or to choose the men best adapted to the work? When an employer has to let employes go, he will naturally want to dispense with the services of those least profitable to him, and it is not only right that he should do this, but in the end it is manifestly better for the men themselves, for it is only by some such process of natural selection that each man who works can be in the position where he can work most efficiently, and with the best returns to himself.

In this case, however, the main difficulty seems to have been that the men claimed that some of their number had been discharged solely because they were members of the Knights of Labor. This charge the railroad officials denied, and claimed they had made no discrimination, but Mr. Webb refused to meet the men's representative who called to talk with him about these matters, and ordered him to leave his office—a line of behavior which, human nature being as it is, he should have known would almost certainly have resulted in trouble for his road, and for the public depending upon it for transportation. For this the almost universal public sentiment seems to be against him. No harm can ever come from a candid and courteous discussion of differences, while much harm has repeatedly resulted from a refusal of one or both parties to do this or to listen to reason.

Studying to Improve System of Doing Running Repairs.

The minor details on a locomotive represent a large investment of money, and the repairs of small parts constitute a large percentage of the outlay represented in running repairs. Half the time put in by machinists on locomotives in roundhouses is done in grinding in some of the numerous valves, or repairing or tinkering at injectors or brakes. Where a road is short of power a larger force of men are required to keep up these repairs, as they have to be done hurriedly in order to keep the engines in service.

It has got so now, especially where they double or treble crew engines, that no attempt is made to repair an air-pump or an injector in place—they are taken off to be repaired at leisure and replaced by others known to be in working order.

This plan can and ought to be carried just as far as possible in all running repairs—replace, instead of repair parts.

On a few roads it is customary to take out globe or angle valves and put in new ones when in a hurry; but it is not necessary to break so many steam joints. For the same money as now paid for plain valves, a class of valves requiring no grinding of the seat can be had; these valves have a round seat and a loose button-valve with a disk of Jenkins packing or prepared asbestos to form the joint, these disks are removable from the stem and can be replaced in one minute, extra buttons or valves costing but a few cents—this saves time, does not require extra skilled labor, and is a better job when done than the old, ground valve.

Every steam valve in a locomotive cab—except the gauge cocks and glass—ought to be tapped into a fountain, or duck's nest, and so arranged that one large valve would shut off the whole from the boiler, then any valve can be made as good as new in less than ten minutes with a full head of steam on.

Some day driving-box wedges will be arranged just as solid-ended rods are—so that there will be no adjusting them—then side rods will be repaired and boxes adjusted together, there will be fewer cut wedges, shoes and boxes, and no stuck ones. Systematic repairs, or rather renewals, will then be made on a mileage basis and side rods will be interchangeable.

There is a chance to save considerable expense in running repairs, and we are of the opinion that it can be done easiest by scheming to replace instead of repair worn parts, and every mechanic in the line should study to get his work into such shape that by simply taking off something and hanging a duplicate on he can let the engine go out.

The idea of letting an engine lay in for a couple of boiler makers to stand on her finished work all day to put in a new cone or stack netting, is old fogy; give her a new stack and let the men repair the old one at their own benches, where they do not have to carry tools and material to and from the work.

Repairs that are made in the shop, when there is no hurry, and time given for a good job to be done and tested, will last a great deal longer than the "good enough for this trip" excuses with which so many American locomotives run from day to day.

We recently saw a passenger engine laid in because she had a broken air-pump, and they had sent a freight engine—without air—out on her run. When we asked the foreman if he didn't have an extra air-pump he said, "Oh, yes, but this one is not broke so as we can't repair it all right." It seems never to have occurred to him to put the extra pump on and keep the engines on their own runs.

This was on one of those roads where every piece, great and small, is branded with the number of the engine, and it is not to be supposed that water would go through check valve number 186 and into boiler number 219 and know what it was doing.

A little intelligent exercise of gray matter in this line will save time, confusion and—dollars.

For M. C. B. Standards.

John W Cloud, secretary of the Master Car Builders Association, has issued a pamphlet stating clearly the questions, and calling for letter ballots on the adoption of a standard journal box lid for 60,000 pound cars, 40,000 pound cars; racks for loading bark and logs on cars; draw-bar and safety chains for passenger equipment cars; brake beam levers and train pipe for steam heating.

The votes will be yes or no on the following questions.

a Are you in favor of the adoption, as a standard of the association, of the journal box bearing (with wedge) and malleable lid for 60,000 pound cars, as shown by drawings on plate "A," when modified as above explained as to lid?

b. Are you in favor of the adoption, as a standard of the association, of the same form and size of malleable lid for the journal box for 40,000 pound cars?

c. Are you in favor of the adoption of the plans shown on plate "C" for loading logs and poles on cars, as standard?

d. Are you in favor of the adoption of the plan for racking cars for loading bark, as shown on plate "D," as standard?

e. Are you in favor of the adoption as the standard height for draw-bars on passenger equipment cars, of 35 inches from top of rail to center of draw-bar, when car is light?

f. Are you in favor of the adoption as standard, of the size, location and arrangement of safety chains for passenger equipment cars, as shown on plate "E," with all links made of $\frac{3}{4}$ inch iron, and $1\frac{3}{4}$ inches wide inside?

g. Are you in favor of the adoption, as standard, of 40 degrees as the lateral angle which the brake beam lever makes with the vertical?

h. Are you in favor of the adoption, as a standard of the association, of a fitting on the ends of train pipe for steam heating, consisting of a 2-inch female pipe fitting with standard pipe thread?

The Wrong Remedy.

We take the following item from the *Master Mechanic:*

Some recent engines of the American type are credited with a weight of 80,000 pounds on the drivers, or 20,000 pounds per wheel. It seems to us that such great weights as these very nearly, if not quite, reach the limit beyond which it is unsafe to go if cast-iron is to be retained as the material for wheel centers. The calculation of the magnitude of the stresses in a driving wheel in revolution on the road is so exceedingly complicated as to be useless for any practical purpose, even supposing its results to be approximately correct, which is doubtful. We have, therefore, to rely entirely on the teachings of experience, and that kind of sense that is generally, but erroneously, called common. But although failures of driving wheels are fortunately rare, and convey scant information when they do happen, we certainly think it is high time that more serious attention was being paid in this country to other materials, notably wrought-iron and steel, for this purpose, if we are to continue to enjoy the immunity from fractured drivers that we have in time gone by.

This seems a strange proposition from a mechanical paper. If it were necessary, there is not a locomotive builder in the country that would not put double the load mentioned on a cast-iron wheel center. It is the driving box that can't stand the load, and must be enlarged and improved as the load upon it becomes heavier.

Train wrecking has become so safe that its prevalance everywhere is not to be wondered at, unless it is to be wondered at that human beings can bring themselves to murder innocent workmen for petty spite at their employers or for purposes of robbery. In almost every case of train wrecking the engineer and fireman lose their lives, it is seldom a passenger is hurt. Every week some poor fellow is brutally butchered in this way, and we hear only the old excuse, "No clue to the perpetrators of the crime." Placing obstructions on a railroad track should be a capital crime, and counties or districts where such murders take place should be made to find and punish the criminals or pay for the lives and property destroyed.

Promotions.

L. C. Hitchcock roundhouse foreman on the M., St. P. & S. S., M Ry. at Minneapolis, who is well known to our readers through his clear and concise contributions on running repairs, has lately reaped some of the benefits to be derived from efforts to be somebody. He has just been appointed general foreman of the main shops of the "Soo" road. Hitchcock is not through yet, he has but just started.

Mr. William Buckley, an engineer of the Louisville, Evansville & St. Louis road, has been made assistant master mechanic of that road.

A. W. Gibbs, Division M M., of the Richmond & Danville, at Alexandria, Va., has been appointed Supt. of M P. of the Georgia Central road Mr. Gibbs is one of the brightest young master mechanics in the country.

George W. Tilton, for many years past Supt. of M P of the Chicago & Northwestern road, died on the 17th inst from injuries received in a derailment. Mr. Tilton learned the machinist trade at the Manchester Locomotive Works, and went from there to the C. & N. W at its inception. William Smith, Asst. Supt. of M P, will succeed him.

Books Received.

POOR'S MANUAL OF RAILROADS FOR 1890 Twenty third annual number H V & H W Poor, 70 Wall street, New York. Price, $6.

This well-known work on railroads has been issued for 1890 and the present number maintains the standard of excellence that has kept up for years its well earned reputation The book contains upward of 1 500 pages, and is recognized both at home and abroad as a reliable record of railway progress and upon the financial standing of railroad property

The special new feature this year is the addition of fifty-one new maps of systems of roads that are correct, and show not only the location of the road, but the topographical features of the territory as well. It takes a well-informed railroad man to follow all the ramifications of his own road, if it is a large one, and few, if any, of the average railroad investors, could point out on a general map the line of any road These maps will be of especial value, and will, no doubt, be added to from year to year until all the large lines are so shown.

The general exhibit for the fiscal year ending December 31, 1889, makes very interesting reading, and from it we cull a few points as follows Length of tracks in United States, 161,896 64, increase for the year, 6,268,43; total liabilities of companies owning this mileage, $9,931,153,116, total assets of same, $10,205,493,020 During the year passenger trains ran 279,620,145 miles; freight trains, 430,719,737 miles, and mixed trains, 18,432,291 miles, or a total of 728,772,142 miles. There were 495,124 767 passengers carried, which equaled one passenger being carried 11,905,720,015 miles There were 619,137,237 tons of freight moved, that equaled 68,601,012,894 tons being moved one mile. For this work the roads received $992,856,856, and paid out for operating expenses the sum of $674,731,517, which left a balance of net earnings of $318,125,339; and they received from other sources, such as rentals, etc., enough to make the net earnings $406,929,187 From this amount there was paid in interest, etc., the sum of $376,102,967, leaving an excess of available revenues over actual payments for the year of $30,220,520.

"Poor's Manual of Railroads" stands alone in its particular field, and is as valuable to the railroad official, the investor and the bankers, as a pen to the copyist

REPORT ON THE SUBSTITUTION OF METAL FOR WOOD IN RAILROAD TIES By E E Russell Tratman, C. E Government Printing Office, Washington

This report is a very elaborate review of the tie question, and contains a vast amount of information on what has been done with metal ties in every part of the world. Accompanying the report are plates showing the forms of all known metal ties. Any one interested can, we presume, secure a copy free through the Congressman from his district.

THE LAW OF WAGES, THE RATE AND THE AMOUNT By John Richards. Industrial Publishing Co., San Francisco, Cal. Price, 25 cents.

This little work is a series of short chapters on the labor problem, from the pen of the venerable editor of *Industry*, a Pacific coast mechanical paper The author lays great stress on the difference between the *rate* and the *amount* paid to labor.

The work is interesting and valuable, inasmuch as it points out the inequalities and wrongs in wages as now paid to labor, but it offers no particular remedy except in increasing the efficiency of labor and thus the reward The book is worth far more than its price to any one interested in the subject of labor

ASKED & ANSWERED.

(55) C. B. N, Galena, Ill., asks

Why does an engine's driver brakes hold better when the piston has less travel? *A.*—Other things being equal the length of stroke will make no difference with the retarding power of the brakes.

(56) A L. D., Port Royal, B. C., asks

What is the weight and size of the Denver and Rio Grande heavy, narrow gauge consolidation locomotives? *A* —Weight, 72 000 pounds, 62,000 on drivers, cylinders, 16"x22"; driving wheel, 36"; smallest ring in boiler, 52", gauge of track, 36".

(57) Reader, Cherokee, Iowa, asks

Which gives the most strength in putting patch on cylinder part of boiler in front, where it connects to front flue sheet in a half round shape, to let back of patch rest on inside of boiler, or lap it on outside, of course using the same number and same size rivets in each case (see sketch) *A.*—Either form will be strong enough, and it should be located where it is the easiest to work on to do a good job.

(58) J P. D., Aspen, Col., asks

How do you find the radius of a curve when the degree is given? Any railroad man can form some idea of the size if you tell the radius all he has to do is to imagine part of a circle so many feet to the center, but I for one can't get any idea of the size when they talk about degrees *A* —You can find the radius of any curve when the degree is given by dividing 5,730—the radius of a one degree curve—by the degree Dividing this figure by 28 gives $204\frac{9}{14}$ feet the radius of a 28 degree curve

(59) Green Fireman, Dexterville, Wis., asks

Should you break off both hose connections what would you do? *A* —First close both tank valves to save water then repair break if possible, whether you can do so or not depends on where the rupture takes place; sometimes a goose neck is broken on one side and the hose on the other, then, by putting the good hose on the good goose-neck, water can be got into the boiler No two accidents of this kind are likely to be the same, and no rule can be formulated; the ability to meet and overcome obstacles of this kind distinguish the real locomotive engineer from the helpless stopper and starter

(60) J. E. Waterville, Me, asks

Why, in the case of mogul and consolidated engines parallel rods could not be made in one forging instead of using two or three rods with knuckle joints as is commonly done I understand about the difference it makes in handling them in taking down and putting up, and suppose that a thing like a low joint would be bad for one continuous rod Now I want to know if there are other reasons against it *A* —On an uneven track the right rod would be bent or broken, or would break the pins, even on an absolutely level track there would be enough movement of the driving boxes to cause the pins to heat and cut

The report recently published about the discovery in Germany of a worm that eats steel rails and beams, reminds us of the excuse of an engineer in the far West, who scorched the rafter bolts of his crown sheet. When asked how it happened, he facetiously said it was on account of the fireman, who had taken water with worms in it, and they had eaten off the crown stays.

Pedrick & Ayer, of Philadelphia, have issued a pocket price list of their special railroad tools that is very handy and neat. It contains cuts, a brief description, and the price of all the machines and tools built by them.

Frank Johnson sends us a dollar bill for a year's subscription, but does not tell where he is, and his letter was mailed on the cars If Frank will name his town and State the paper will reach him.

Some Early Valve Motions.

SYSTEM OF TWO LOOSE ECCENTRICS

Probably the device used by Jackson in England was the best known of the "loose eccentric" breed of valve gears, and while it is probably fifty years since one of them has been built for locomotives, practically the same thing is still in use on some classes of small steamers.

Jackson's early engines, like Stephenson's, had but four coupled wheels, without trucks, and were of short wheel base; he placed the eccentrics on the back axle, extending the rods, or hooks, through to the front of the engine, and there engaging the rocker shafts that moved the valve stems, the latter entering the *front* of the chests.

Our illustration shows a plan of the motion, looking at the bottom of the engine. The rocker shafts were in front of the cylinders, and the arms of these shafts entered a hole in the end of the valve stems and moved them, sliding up and down in the slot in so doing.

A set of levers extended back to the cab for hand use, and the engine could be worked by hand in either direction when the eccentrics were out of gear. The two eccentrics were made in one piece, or fastened together, and had on each side a steel plate with holes in them These holes engaged with pins fixed in collars each side of the eccentric. When moved in either direction these holes were caught by the pin in the fixed collar, and moved the motion with the axle. When the eccentric block was midway between the collars, the axle revolved in it, and no motion was transmitted to the valves

A forked lever, such as used in clutches, was placed in the recess in the center of the eccentric blocks, and so arranged that, by pressing a treadle on the footboard, the eccentric block could be engaged with the pin in either collar, or held central between the two without revolving. It is needless to say that the pin in one collar when engaged with the eccentric block was so set as to run the engine in one direction, while the other pin would cause it to move in the opposite direction.

The eccentrics were placed at right angles to each other, and when the engine was moving, and it was desired to reverse, the shaft would make a partial revolution after the eccentric was disengaged from one collar before it could be engaged with the other.

If the engine was standing, and in, say, forward gear, and the runner desired to back up, he would place his foot on the pedal and disengage the eccentric from one collar, and hold it against the other, and move the engine until it hooked onto the opposite collar If the engine would not so move; he would unhook the eccentric rods by use of the levers then move the engine by use of the hand gear until the eccentric caught.

This form of gear was trappy, very liable to derangement, and was, of course, a full stroke gear, like the single fixed eccentric

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Under the heading of "Death and Doggerel," the editor of the *Locomotive Fireman's Magazine* puts his foot down and declines to publish any more mongrel poetry dedicated to the poor fellows who lose their lives on the road, or in any other way. Those who have laid down their lives are helpless against the poetry (?) fiends and should be left alone. The *Magazine* is progressive.

Our correspondent, W. H. Ermentrout, after several years of service in the P. & R. shops at Reading, Pa., has established himself in business. He will manufacture a new device for lining up locomotive guides, a new plumb bob, valve motion models, and any other small tools or devices that seem to have merit.

A Midsummer Night's Trip, and What Came of It. A Frontier Fable.

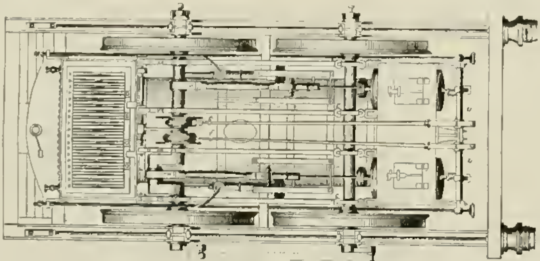
BY JOHN ALEXANDER.

It's more than ten years ago now, since the little incident happened that I am going to tell you about It don't amount to very much, and railroading has mighty little to do with it, but I just thought that, perhaps, it might interest the boys, and go to show how it is that men in the transportation department push themselves ahead of us conservative fossils in the motive power and get things that we want, and, perhaps, ought to have. After the strike of '77, you will remember, I went into exile in the wild and woolly West, mostly in "bleeding Kansas," but often in Colorado, New Mexico, and Arizona—the Santa Fe gets almost everywhere in the Southwest.

One night in August, I was dropping an old Baldwin consolidator down a long New Mexican grade, after having "helped" a stock train over the division by "double-heading." It was close and hot on this sage-brush waste, something not usual at night in high altitudes, and the heat and the sheet lightning around the horizon warned me that there was to be one of those short, fierce storms that come but once or twice a year in these latitudes, and which are known as cloud bursts.

The alkali plains, or deserts, as they are often erroneously called, are great stretches of adobe soil, known as "dobie" by the natives. This soil is a yellowish brown, or perhaps more of a gray color, and as fine as flour.

Water plays sad havoc in it, if its shape is such



Connecting rod to couple the wheels when the engine conveys goods

LOOSE ECCENTRIC VALVE GEAR.

as to oppose the flow, and it moves like dust before a slight stream On the flat, hard baked plains, it makes no impression, but on the railroad grade, be it ever so slight, the tendency is to dig pitfalls. I have seen a little stream of water, just enough to fill the ditches on each side of the track, take out all the dirt, and keep the ties and track afloat until the water was gone, then drop them into a hole eight or ten feet deep, or if the wash-out was short, leave them suspended, looking safe and sound, to lure some poor engineer and his mate to death.

Another peculiarity of these storms is that they come quickly, rage furiously for a few minutes and are gone, and their lines are sharply defined, it is not uncommon to find a lot of water, or a wash out, within a mile of dry dirt that looks as if it never saw a drop of water

All this land is fertile, if it can be brought under irrigating ditches and watered, but here it lays out almost like a desert. It is sparsely inhabited along the little streams, by a straggling offshoot of the Mexican race; yet once in a while a fine place is to be seen, like an oasis in the Sahara, the home of some old Spanish Don with thousands of cattle or sheep ranging on the plains, or perhaps the headquarters of some enterprising cattle company. But these places were few and far between, at the time of which I write; the stations were mere passing places, lone side tracks, with perhaps a stock yard and section house, once in a while, but generally without buildings, or even switchlights.

Noting the approach of the storm, I let the heavy engine drop the faster, hoping to reach a certain side track, over twenty miles away, where there was a telegraph operator, and learn from him the condition of the road. But the storm was faster than any consolidator that Baldwin's ever built, and as the lightning suddenly ceased, and the air seemed to become heavy, hot and absolutely motionless, I realized that we would have a furious storm upon us in a few moments.

I had nothing to meet for more than 30 miles, and there was nothing behind me, so I stopped, turned the headlight up, and hung my white signal lamps down below the buffer beams, each side of the pilot—this to enable me to see the ends of the ties and the ditch.

Billy Howell, my fireman, and a good one, hastily went over the boiler jacket with signal oil to prevent rust; we donned our gum coats, I dropped a little oil on the Mary Ann's gudgeons, and we proceeded on our way without a word. On those big consolidations you can't see well ahead, past the big boiler, from the cab, and I always ran with my head out of the side window. Both of us took this position, standing up ready for anything, but we bowled safely along one mile, two miles, through the awful hush, when as sudden as a flash of light, "boom!" went a peal of thunder as sharp and clear as a signal gun; there was a flash of light along the rails, the surface of the desert seemed to break out here and there with little fitful jets of greenish-blue flame, and from every side came the answering report from the batteries of heaven, like sister gun-boats answering a salute. The rain fell in torrents, yes, in sheets. I never before or since saw such a grand and fantastic display of fireworks, nor heard such rivalry of cannonade I stopped my engine, and looked with awe and interest at this angry fit of nature, watched the balls of fire play along the ground, and realized, for the first time, what a sight was an electric storm.

As the storm commenced at the signal of a mighty peal of thunder, so it ended as suddenly at the same signal; the rain changed, in an instant, from a torrent to a gentle shower, the lightning went out, the batteries ceased their firing, the breeze commenced to blow gently, the air was purified. Again we heard the signal peal of thunder, but it seemed a great way off, as if the piece was hurrying away to a more urgent quarter, the gentle shower ceased, the black clouds were torn asunder overhead, invisible hands seemed to snatch a gray veil of fleecy clouds from the face of the harvest moon, and she shone out as clear and as serene as before the storm. The ditches each side of the track were half full of water, ties were floating along in them, but the track seemed safe and sound, and I proceeded cautiously on our way. Within two miles the road turned to the west, and I found the water in the ditches running through dry soil, carrying dead grass and twigs of sage upon its surface, and then suddenly passed the front of the flood, tumbling along through the dry ditches as dirty as it well could be, and fast soaking into the soil—we had passed beyond the line of the storm.

Billy put up his seat and filled his pipe, and I sat down and absorbed a sandwich, as I urged my steed ahead to make up for lost time; we took up our routine of work just where we had left it, and —life was the same old song.

It was past midnight now, and as I never did a great deal of talking on an engine, I settled down to watching the rails ahead, and wondering if the knuckle joints would pound the rods off the pins before we got to the end of the division.

Billy was smoking his second pipe of weed, and humming a tune, with his eyes on the track ahead, and the Mary Ann was making about forty miles an hour, but doing more rolling and pitching, and jumping up and down, than an eight-wheeler would at sixty. All at once I discerned something on the track away down where the rails seemed to meet; the moon had gone behind a cloud, and the head light gave a better view, and penetrated farther, Billy saw it too, for he took his pipe out of his mouth, and, with his eyes still upon it, said laconically, as was his wont

"Cow"

"Yes," said I, closing the throttle, and dropping the lever ahead.

"Man," said Billy, as the shape seemed to assume a perpendicular position.

"Yes," said I, reaching for the three-way cock, and applying the tender brake, without thinking what I did

"Woman," said Billy, as the shape was seen to wear skirts, or at least drapery.

"Mexican," said I, as I noticed the mantilla over the head. We were fast nearing the object.

"No," said Billy, "too well built."

I don't know what he judged by, we could not see the face, it was turned away from us, but the form was plainly that of a handsome woman; the light clothing fitted the form like a glove. She stood between the rails, with her arms stretched out like a cross, her white clothes fitting her form tightly, and a black, shawl-like mantilla over the head partly concealed the face; her right foot was upon the left-hand rail—she stood stock still.

We were within fifty feet of her, and our speed reduced by half, when Billy said sharply:

"Hold her, John—for God's sake."

But I had the Mary Ann in the back motion before the words left his mouth, and was choking her on sand.

Billy sprang upon the boiler-head, and pulled the whistle cord, but the white figure stood still.

I shut my eyes as we passed the spot where she had stood, and as we stopped a rod or two away, I took the white light in the tank and sprang to the ground. Billy lit the torch, and followed me with alacrity.

The form stood upon the track, just where we had seen it, but it faced us, and the arms were folded.

I confess to hurrying slowly, until Billy caught up with the torch, which he held over his head.

"Good evening, Señors," said the apparition in very sweet English, just tinged with the Castilian accent, but she spoke as if nearly exhausted.

"Good gracious," said I, "whatever brought you away out here, and hadn't you just as lief shoot a man, as scare him to death?"

She laughed very musically, and then said:

"The washout brought me just here, and I fancy it is lucky for you—both of you."

"Washout!" said I, "where?"

"At the dry bridge beyond"

Well, to make a long story short, we took her on the engine, she was wet through, and went to the dry bridge, a little wooden structure in a sag, about a mile away, and found that the storm we had seen some distance back, and out of whose track we had run in a loop and had now returned to, had reached this spot, and played sad havoc at each end of the bridge. We did not cross that night, but after placing signals well behind us, and ahead of the washout, we waited till morning, and all three of us sat in the cab of the Mary Ann, chatting as if we were all old acquaintances.

This young girl, whose fortunes had been so strangely cast with ours, was the daughter of Señor Don Juan Arboles, a rich old Spanish Don, who owned a fine place, and immense herds of sheep, over on the Rio Pecos, some ten miles west of the road.

She was being educated in this city of Trinidad at some Catholic school or convent, and had, the evening before, alighted at the Big Corrals, a few miles below, where she was met by one of her father's Mexican rancheros, who led her saddle broncho. They had started on their fifteen-mile ride in the cool of the evening, and following the road back for a few miles were just striking off toward the distant hedge of cottonwoods that lined the little stream by her home when the storm came up.

There was a lone pinon tree about half a mile from the track, and riding to this, Miss Josephine (pronounced Hosepheta in Spanish) had dismounted to seek its scant protection, while the herder tried to hold the frightened horses, as peal on peal of thunder resounded, and the electric lights of nature played tag over the plain, the horses became more and more unmanageable, and at last stampeded, with old Paz muttering Mexican curses, and chasing after them wildly.

After the storm broke, Miss Josephine waited a lonely hour for Paz and the bronchos, and then debated whether or no she would walk home, or back to the Corrals.

Adobe soil is very tenacious when wet, and the wayfarer needs great strength to carry the load it imposes upon the feet; then again, she thought of the half mile of timber along the river, and the fact that timber wolves invariably found all the stray sheep left outside the corral; then she knew the ford would be a torrent and impassible, and as she stood there thinking what was best to do, and of the long miles between her and other human beings, a sound came to her ears from the direction of the timber and from home; she recognized it in an instant, and without waiting to think further, or to again strain her eyes for a sight of Paz, she turned and ran with all her strength, not toward home, but—away from it.

Across the wastes of stunted sage she sped, the cool breeze upon her face, her strong, young muscles bent to carry her away, and her heart brave and fearless, for she was raised amid the dangers of the frontier.

Nearer and nearer came the sound, deeper and deeper sounded the regular bay of the dreaded timber wolf. These animals are large and fierce, they do not go in packs like the smaller and more cowardly breeds of wolves, but in pairs, or, at most, six together, a pair of them will attack a man even when he is mounted, and lucky is he, if well armed and cool enough to dispatch one before it fastens its fierce fangs in his horse's neck or his own thigh.

As this brave girl ran, she figured upon her chances of life, and what she would do, and before she had gone a hundred yards had mapped out a plan for her own safety, that under ordinary conditions would have been successful, but "the best laid plans o' mice and men gang aft agley."

Her plan was to run to the track and climb a telegraph pole, which, owing to her free life at the ranch, she knew perfectly well how to do, by resting upon the cross-tree she could laugh at her tormentors, because they cannot climb, and she would be sure to be seen and rescued by the first train that came along after day-break

As she approached the track she ran upon dry ground, and found that the telegraph poles were upon the other side of it; she sprang nimbly into the ditch, and as she did so, saw something moving rapidly toward her—it was the front of the flood. On the opposite side it had passed and barred her from the line of poles—her plan was foiled. Instantly she decided to run up the track between the walls of water, this would put a ten-foot stream between her and her pursuers, and change her course enough, she hoped, to throw them off the scent. In this surmise she was partly right, for the regular bay showed that they were going direct to the track, as she had gone, instead of cutting across toward her; in this way she gained considerable. She reached the little aroya spanned by the dry bridge; it was like a mill pond, but the track was afloat, and across it she scarcely slackened speed, although the ties rocked and moved on the spike heads holding them to the rails.

She hoped the hungry brutes would not dare pass this place, even if they gained the track, and as she sped along, her heart sank as she noted pole after pole down and afloat in the ditch—there was no lessening of the flood—and heard the hideous voices of her tormentors directly in the rear

So close came the bay that she glanced over her shoulder to see if they were in sight, but she saw only the nodding heads of sage But a strange, metallic sound greeted her strained ears, what was it? Where was it? She ran on tip toe a few paces in order to hear it better; it was in the rails, the vibration of a train in motion. She glanced up, a star shone directly between the rails, no, it was a light, a train, a headlight, but it was so far away, so very far, and that awful baying so close. But the Mary Ann was fleeter of foot than the beasts upon her track, the light grew big and bright, and the sound of working machinery came to her on the breeze.

Would they stop for her, could she make them see her? Then she thought of the bridge; it was death for them as well as her—they *must* see her. She resolved to stay on the track until they whistled her off, but now the light seemed to come so slow. A splash at her side caused her to turn her head, and there, a dozen feet away, were her pursuers, their tongues out, their eyes shining like balls of fire, and just entering the water to come across to her. They fascinated her by their very fierceness, and forgetting where she was, for the moment, she looked dumbly at her enemies, until called to life and action by a scream from the Mary Ann's whistle, that echoed across the desert wastes like the wail of a lost soul.

She sprang from the track just in the nick of time, and actually laughed as she saw two grayish-white wolf tails bob here and there among the sage brush as they made themselves scarce. This was the story she told us as she dried her clinging garments before the furnace-door of the Mary Ann, and I confess to holding this cool, self reliant girl in high esteem—she never once thought of swooning—but along toward morning did say that she was scared then, just thinking of it.

Early in the morning a party of herders, with Josephine's father ahead, rode into sight, they were hunting for her. Josephine got up on the tender and attracted their attention, and soon she was in her father's arms. Her frightened pony had gone home as fast as his legs would carry him, and a relief party swam their horses at the ford, and rode forward at once.

The old Don was profuse in his thanks, and would not leave us until Billy and I had agreed to visit his ranch and enjoy a hunt with him, and actually set a date when we would meet him at the Big Corral.

I wanted a rest anyway, and it was perfectly plain that Billy was beyond his depth in love with the girl at first sight, so we were not hard to persuade when she added her voice to her father's.

Early in September Billy and I dropped off of No. 1 with our guns and "plunder," as baggage is called there, and a couple of the old Don's men met us with saddle and pack animals

I never spent a pleasanter two weeks in my life, the quiet, almost gloomy old Don and I became fast friends, and the hunting was good. The Don was a Spaniard, but Josephine's mother had been a Mexican woman, once noted for her beauty, those Mexican girls are plump and fully developed maidens at 15, matrons at 20, and hags at 30 or 35, Josephine's mother had been dead some years, at the time of our visit.

Billy devoted most of his time to the girl, and they were a fine looking young couple, he being strong and broad shouldered, with laughing blue eyes and light curly hair, she slender and perfect in outline, a typical Southern complexion, black eyes, and such eyes they were, long hair and eyebrows like a raven's wing—a perfect type of Spanish beauty.

A few days before we were billed to resume our duties on the deck of the Mary Ann, Miss Josephine took my arm and walked me down the yard, and pumped me quietly about Mr. Howell, as she called Billy, she went into detail a little, and I answered all questions as best I could, and they were all in the young man's favor—I could not do otherwise, he deserved it She seemed satisfied and pleased

When we got back to headquarters, I was given the care of a cold-water Hinkley, with a row of varnished cars behind her, and Billy fell heir to the rudder of the Mary Ann. We still roomed together, and Bill put in most of his lay-over time writing long letters to somebody, and every Thursday as regular as a clock one came for him, with a censor's mark upon it. Often after reading one Billy would say

"That girl has more horse sense than the rest of the whole female race—she don't slop over worth a cent"

Billy invariably spoke of her as "my Mexican girl," and often asked my opinion about white men intermarrying with that mongrel race.

Sometimes he would say that his mother would go crazy if he married a Mexican, his father would disown him, and his brother Henry—well, Billy didn't like to think just what revenge Henry would take.

Billy's father was manager of an eastern road, and his brother assistant to the first vice-president, and Billy looked up to him as to a great man and a sage. Billy was West for practical experience in the machinery department, and to get rid of a slight tendency to asthma—he could go East any time, and "be somebody" on the road under his father.

Finally Billy missed a week in writing—there was a cog gone from the answering wheel from the other side to match. Billy shortened his letters—the answers were shortened. Then he quit writing, and his Thursday letter ceased to come.

Billy had thought the matter all over, and decided, no doubt, that he was doing what was best, both for himself and the girl, and his family's high-strung ideas of *caste* would not be outraged by a Mexican marriage—Billy had put a piece of flesh-colored court plaster over his wound, not healed it.

Early in the winter, the old Don wrote, urging us to come down and hunt antelope, but Billy declined to go; said the road needed him, and that Josephine might come home from school, and that would make them both uncomfortable. But Henry, his older brother, was visiting him, and I could take him, he would enjoy the hunt, and help him drown his sorrow over the loss of his aristocratic young wife, who had died a year or so before. So Henry went with me, and we hunted antelope till we tired of the slaughter. Then the old Don planned a deer hunting trip in the mountains, but I had to go back to work, and the young railroad officer and the grave old Don took their trip together. While they were gone Josephine came home, and Henry Howell's stay lengthened out to a month, but I did not know that he had met the young lady till long after.

Billy was pretty quiet all winter, worked hard, and went but little—he was thinking about something. One day I came home and found him writing a letter. "What now, Billy?" I asked.

"Writing to my Mexican girl," said he.

"I thought you got over that a long time ago."

"So did I, but I didn't; I've been trying to please somebody else beside myself in this matter, and I'm done. I'm going to work for Bill now."

"Take an old man's advice, Billy, and don't write that girl a line—go and see her."

"Oh, I can fix it all right by letter, and then will run down there."

"Don't do it."

"I'll risk it."

A week later Billy and I sat on the veranda of the company's hash foundry, figuring up our time and smoking our cob meerschaums, when one of the boys who had been to the office, placed two letters in Billy's hands. One of them was directed in the handwriting that used to be on the old Thursday letters. Billy tore it open eagerly, and—his own letter to her dropped into his hand.

Billy looked at the ground steadily for five minutes, and I pretended not to have seen; finally he said, half to himself:

"You was right, I ought to have gone myself, but I'll go now, go to-morrow," then he opened the other letter.

Billy read its single page with interest, and when his eyes reached the last line, they went straight on and looked at the ground again for fully five minutes. Without looking up, he said:

"John, I want you to do me two favors."

"All right," said I.

Keeping his eyes where they were, he said slowly, as if measuring everything well:

"I'm going up and draw my time, and will leave for Old Mexico on No. 4 to-night. I want you to write to both these parties, and tell them that I have gone there, and that you forwarded the letters; don't tell 'em I went after reading 'em."

"And the other favor, Billy?"

"Read this letter, and see me off to-night."

The letter read:

Phila., May 1, 1879.

DEAR BRO. WILL—I want you and Mr. A to go down to Don Juan Arboles by the first of June. I will be there then. You must be my best man, as I stand up to marry the sweetest, dearest wild flower of a woman that ever bloomed in a land of beauty. Don't fail me. Josephine will like you for my sake, and you will love her for your brother. HENRY.

Most engineers' lives are busy ones, and full of incident and accident, and having my full share of both, I had almost forgot all these points about Billy Howell and his Mexican girl, when they were all recalled by a letter from Billy himself a few days ago. With his letter was a photo. of a family group, a bewhiskered man of 35, a good-looking woman of 20, but undoubtedly a Mexican, and a curly-headed baby, perhaps a year old. The letter read:

City of Mexico, July 21, 1890.

DEAR OLD JOHN—I had lost you, and thought perhaps you had gone over to the majority, until I saw your name, and recognized your quill in THE LOCOMOTIVE ENGINEER. Write to me; am doing well. I send you a photo. of all there are of the Howell outfit. *No half breeds for your uncle this time.* WM. HOWELL.

New Valve Gear for L. P. Cylinder of the Webb Compound.

Mr F W Webb, chief mechanical engineer of the London & Northwestern road, has recently turned out some compound locomotives, of his well-known three cylinder design, in which he has very much simplified the valve gear for the large cylinder. Instead of using the Joy gear for this cylinder, handled from the cab by an extra reverse lever, like the one on the P. R R., he uses a single eccentric; this eccentric is loose on the shaft and has two stops on the crank throw that prevent its turning. The gear is entirely out of the hands of the engineer; if a stop is made, and it is desired to reverse, he reverses the high-pressure engines, and as soon as they move the engine the stop on the crank throw leaves the loose eccentric against which it has rested, and when part of a turn of the axle has occurred the second stop moves the eccentric so as to admit steam right for the reverse motion.

The new engines also have a "bye-pass" valve in the exhaust pipes of the high-pressure cylinders, to admit of their exhausting directly into the stack, leaving the low-pressure engine temporarily out of business.

The Mahoney Foot Guard.

Every year there are a lot of switchmen and brakemen who lose their lives by being caught in frogs or guard rails and run down. In some States there are laws requiring frog and guard rail openings to be filled with wood or other material, but, as a usual thing, this is worse than useless, as it must be as low as the deepest flange, and makes it harder, if anything, to get the foot out once it is caught. The best device we have heard of for this work is one invented by yard-master Mahoney of the St. Louis & San Francisco road, at St. Louis. His guard consists of strips of sheet steel cut at one end to fill the tapering openings at frog points and the ends of guard rails, the other end is bent down, and riveted or bolted to the bottom plate or base of rail. This spring stands flush with the ball of rail, will hold 300 pounds, and so keep the feet of workmen out of the traps; the flanges of wheels simply depress the guard until they have passed it, when it springs back to place.

The railroad commissioners of Missouri endorse and recommend this device, and it has met with the approval of many prominent railroad men. It has been in use for some time in the yards of the above road, and at the M P. yard at the Union depot in St Louis.

Trouble with a Very Old Style of Switch Engine.

Last week we announced the death of Henry Baxter, a subscriber to the *Railway Herald*, and a driver of a horse employed in shunting at Toton. The unfortunate man was kicked by the horse and thrown under some wagons, which ran over and killed him. At the inquest the coroner strongly advised the company to remove the horse from the railway. The jury returned a verdict that the deceased was killed by being run over by a wagon, and they were agreed that the horse was not a fit one to be used for shunting purposes.

It was well known to the officials at Toton that the horse in question was vicious and liable to kick, and those in command should have removed such a brute from the line. Their neglect, in the opinion of an authority, gives the widow and three children of our late subscriber a right to claim three years' wages as compensation under the Employers' Liability Act, and we are glad to learn that the necessary notice, as required by the act, has been duly served upon the company, together with the claim for the full amount allowed by law. The case is in very good hands, and will no doubt be successfully concluded.

If railway companies are made to pay damages in these cases we shall soon see "kicking horses"—of which unfortunately there are far too many—removed from our shunting yards. During the year 1889 we find no less than two men killed and 111 injured on railways by being trampled on or kicked by horses.—*Ry. Herald* (England).

Horses used for switching purposes seem more dangerous than locomotives, but some cities insist that no switch engine shall be employed within its limits, on account of the noise. There is no doubt, however, that horses are much more dangerous than locomotives, both to employes and the public.

What Grease Costs.

From the annual report of the C. & N W. Ry the *Railway Age* culls the following:

"Lubricating material forms no inconsiderable item of cost in the operating of any railroad. We find from the report of the Chicago & North-Western railway that the cost of oil, waste and tallow for the year was as follows: Used on locomotives, \$92,064.54; on passenger cars, \$22,498.81; on freight cars, \$69,109.90; on tools and machinery, \$6,960.70; making a total of \$190,634 paid in a single year by one company for these three apparently insignificant items. For the same period this company paid for stationery and printing \$181,104, for salaries of general officers, \$178,097, for renewal of rails, \$172,141; for passenger conductors' wages, \$167,903; for advertising, \$104,911; each of these amounts being much less than the expenditure for 'oil, waste and tallow,' while all the advertising done by this great system cost only little more than half as much as those three inconspicuous items."

At the coming convention of the Brotherhood of Locomotive Engineers there will be, no doubt, some attempt made to lessen the number of delegates to forthcoming conventions. Four hundred men, most of them new to parliamentary proceedings, cannot be easily handled, much less be held down to the routine work. There have been two plans proposed: representation by States or districts or by systems of railroads. The first plan has the disadvantage of giving a very uneven representation, and admits of the clashing of interests and jealousy in electing a representative. The system plan will allow one delegate from each system of road, and will be nearer fair and assemble a more truly representative body; it will also cut down the number of delegates to considerably less than a hundred, and, as these men would in all probability be the most experienced, more work and better work could be done in less time.

Strong brine will kill grass and weeds, root, branch and seed, if you doubt it try it on your lawn. Every year our railroads spend a great deal of money in cleaning the tracks and grade of vegetation. Elaborate machines have been devised for the work, and many men employed, and yet it is seldom thoroughly done. Salt is the cheapest chemical in existence—it sells as low as 50 cents a barrel for the refined article—it costs more to load crude rock salt at Salt Lake, Utah, than the salt itself is worth at the quarry. What is the matter with thoroughly wetting down the line with brine? The plan ought to be efficient and cheap.

On the Suburban Rapid Transit Elevated road in this city they use Forney engines, and to aid them in rounding curves when running with drivers ahead—which they do half the time—they have a device for oiling the flange. This is a short piece of pipe with a wick and a spring in it that rubs the wick slightly against the tire and prevents cutting when rounding curves. Mr. Wetmore, Supt. and M M, we believe, gives THE LOCOMOTIVE ENGINEER the credit for suggesting the plan but he has carried it out so simply and ingeniously we would not have recognized the scheme. It is in use on all their engines.

At an early date we hope to show complete drawings of the valve gear of the "Camel" engines. Their gear was very ingenious and efficient.

A New Track Sander

Henry L. Leach, Jr., who is Assistant Supt. of M. P. of the Fitchburg road, in charge of the Fitchburg shops, has recently patented a track sanding device used by him.

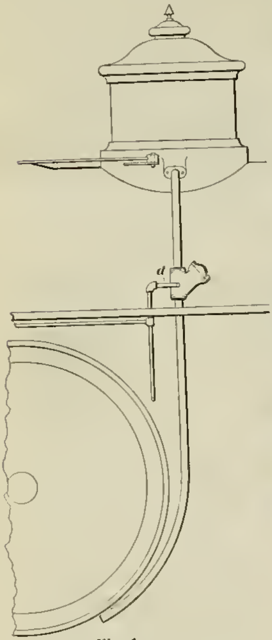


Fig. 1.

His invention consists of a sand trap, in the ordinary pipe as now used, and a jet of air to carry the sand in small quantity to the rails.

Fig. 1 plainly shows his method of applying the trap, and Fig. 2 is a section, on an enlarged scale, of the trap itself. When the sand lever is used a large quantity of sand is allowed to escape from the box, usually much more than can be used for increasing the adhesion of the drivers to the rail, and which is

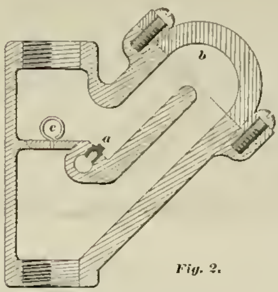


Fig. 2.

taken up and carried by the wheels, causing the train to pull harder and increasing the wear.

With Mr Leach's device the surplus sand stops at the trap, and air pressure from the main drum being turned on through the small pipe *d*, in Fig. 1, entering through the side of trap into an opening in the partition, as shown in Fig. 2, escapes in a small jet directed over the partition, carrying with it some sand.

There is a plug *c* that can be taken out if it is found desirable to use, direct from the box, sand in large quantities.

The cap *b*, of course, will wear fast under the sand blast, and provision is made for renewing it cheaply. Mr. Leach uses an air nozzle about $\frac{1}{16}$ of an inch in diameter.

This device ought to be economical in the use of sand, and distribute it evenly, but it is often desirable to use sand in large quantities, as, for instance, to increase the holding power of brakes, to avoid accident, and to drop under an engine the last length or two, where she takes a siding very hard to back out of. We should suggest in this device that the plug *c* be hinged, and operated at will from the cab.

The new "downward draught" locomotive is being tried, and, as usual with new devices, ridiculous claims made for her

Logging railroads are built under almost as much difficulty as lines are constructed in the African jungles. All the iron and the equipment for the new road now being built by the St. Anthony Lumber Company is to be hauled by team from thirteen to twenty miles, after first having been shipped by rail and boat nearly three hundred miles more. But difficulties of this kind do not intimidate the average lumberman.—*Lumberman*, Minneapolis.

One of the oldest general shop foremen in the country will soon commence a series of short articles on "Running Repairs" in the L. E. Each subject will form a paper by itself, and there will be no "continued in our next" business. Every reader who has a shorter, better or cheaper way of doing work than that shown by our correspondent is expected to explain it in these columns for the benefit of his brother workers.

Engineer Bowels, of the Illinois Central, recently went insane on duty from overwork. It is a wonder that more enginemen do not go insane, there are lots of them running twenty-four and thirty-six hours without rest.

The *Railroad Gazette's* record of train accidents in July includes 84 collisions, 59 derailments and 6 other accidents, a total of 149 accidents, in which 70 persons were killed and 249 injured.

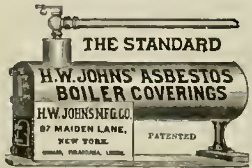
Two Pinkerton men who were assisting in making up a train in the Albany yard, during the recent strike, were run over and killed.

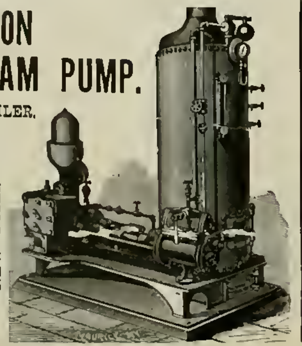
The switchmen of the world seem to have the strike fever. They are "out" from Wales to Missouri.

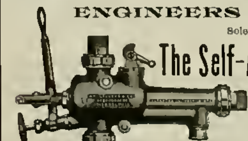
Between 2,000 and 2,500 men went out on the Central—most of them are still out.

On some of the roads in the Andes Mountains coal is worth $25 per ton.


ROGER


H.W. JOHNS' ASBESTOS BOILER COVERINGS
H.W. JOHNS MFG. CO.
87 MAIDEN LANE, NEW YORK.
PATENTED





THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 10 — NEW YORK, OCTOBER, 1890. — $1.00 per Year or 10c. a copy.

Locomotives for Japan.

The Imperial Empire of Japan is fast waking up to the introduction of Western ideas, and is many years in advance of her larger, but less progressive neighbor, China.

There are in Japan several roads of moderate size, and their success has been so marked that a great many miles of new road are projected.

The service is rather light, and tank engines have, so far, been generally employed. Japan is disposed to test the merits of both English and American locomotives, and Baldwins are furnishing several from this side of the world, while the Vulcan Foundry Co. (Limited), of Newton-le-Willows, Lancashire, England, furnish the English machines.

We show on this page the two types of engines. The Baldwin is a mogul, with a six-wheeled tender, and differs little from American practice in the same class, the double buffers and six-wheeled tender being the most noticeable changes. As will be seen, the tank flange is straight, and there is no projecting of the platform under the tank.

The principal dimensions of the Baldwin engines are as follows:

Gauge, 3' 6", standard of the Imperial railways.
Cylinders, 18x22, link motion.
Drivers, 48" diameter, truck wheels, 30".
Total wheel base, 19' 8".
Driving wheel base, 12'.
Total weight, about 85,000 lbs.
Weight on drivers, about 72,000 lbs.
Diameter of boiler, 56".
Number of tubes, 200.
Diameter of tubes, 2".
Length of tubes, 10' 9".
Length of fire-box, inclined grate, 89¼".
Width of fire-box, 29".
Tender capacity, 2,600 gallons.

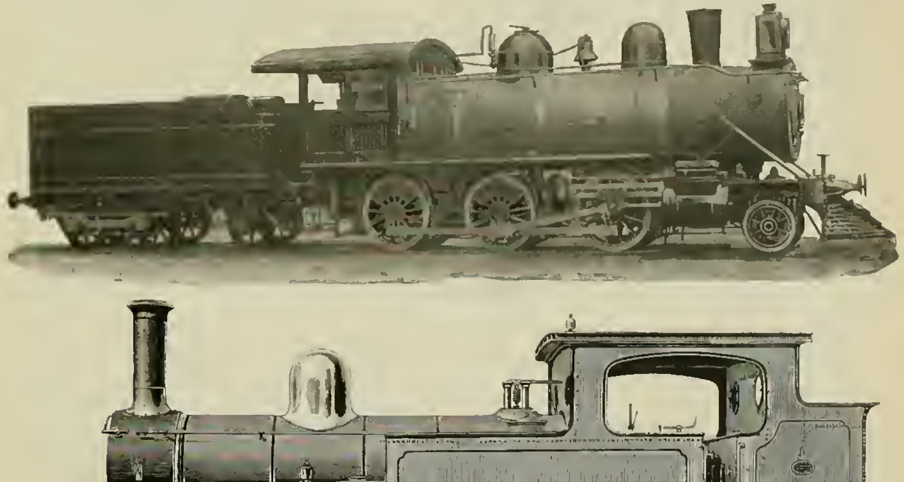
Our second illustration shows the Vulcan Co.'s machine, built for the Sanyo road. The principal dimensions are as follows:

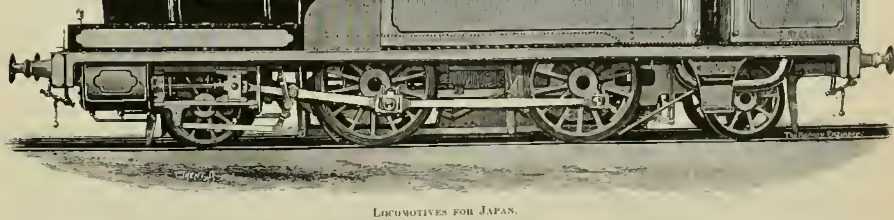
Gauge of road, 3' 6". Cylinders, 14×20, Joy valve gear. Drivers, 4' 4" diameter; both forward and back truck wheels, 3' 1".

The fire-box has 70 square feet of heating surface, and the tubes 654 square feet, making a total of 724 square feet.

Grate area, 12 square feet.

Water is carried in two side and one rear tank with a total capacity of 1,000 gallons, and a coal bunker of 45 cubic feet. For the engraving of this machine we are indebted to the *Railway Engineer*, London, Eng.





Locomotives for Japan.

Committees of the M. M. Association for 1890-1.

The following committees have been appointed to prepare papers on the subjects given, for discussion at the 24th annual meeting held next June.

EXHAUST PIPES, NOZZLES AND STEAM PASSAGES.

Investigate best form and size in proportion to cylinders.

C. F. Thomas, A. W. Gibbs, L. C. Noble, F. C. Smith, John Y. Smith.

TESTING LABORATORIES, CHEMICAL AND MECHANICAL.

George Gibbs, Philip Wallis, G. W. West, L. S. Randolph, D. L. Barnes.

ADVANTAGES AND DISADVANTAGES OF PLACING THE FIRE-BOX ABOVE THE FRAMES.

Fred. B. Griffiths, James Macbeth, W. A. Foster, A. G. Leonard, Louis F. Lyne.

RELATIVE VALUE OF STEEL AND IRON AXLES.

John Mackenzie, J. S. Graham, John S. Cook, E. B. Wall, Thomas Shaw.

PURIFICATION OR SOFTENING OF FEED WATER.

W. T. Small, Harvey Middleton, A. W. Quackenbush, J. B. Barnes, John W. Hill.

THE PRESENT STATUS OF THE CAR COUPLER QUESTION.

Investigate whether this association can endorse the action of the Master Car Builders' Association from a mechanical standpoint in recommending the vertical plane type as a standard.

John Hickey, G. W. Rhodes, Sanford Keeler, R. H. Blackall, M. N. Forney.

EXAMINATION OF LOCOMOTIVE ENGINEERS AND FIREMEN.

On their duties relating to the use of fuel, care of the locomotive, and ability to deal with disorder or disability of machinery; to what extent practiced, and best plan for conducting the examination.

W. H. Thomas, John Player, F. D. Casanave, J. W. Luttrell, L. R. Pomeroy.

OPERATING LOCOMOTIVES WITH DIFFERENT CREWS.

Investigate the comparative advantages of operating locomotives with different crews on the "first in and first out" plan, and that of confining men to certain engines, the latter not running a greater number of miles than can be rendered by their regular crews, discuss any improvement in the method of running engines.

Ross Kells, W. W. Reynolds, W. F. Turreff, C. G. Turner, John A. Hill.

LOCOMOTIVE FOR HEAVY PASSENGER AND FAST FREIGHT TRAIN SERVICE.

Investigate the types best suited for this service, and the relative economy and safety of eight-wheel, ten-wheel and mogul locomotives for the service in question.

Pulaski Leeds, James Meehan, E. M. Roberts, C. E. Smart, W. A. Smith.

ELECTRICAL APPLIANCES FOR RAILROAD USE.

Report on the progress of electricity into motive power, car lighting, signaling, welding and kindred uses.

T. W. Gentry, G. B. Hazelhurst, Albert Griggs, John Ortton, F. W. Dean.

STANDARDS OF THE ASSOCIATION.

Wm. Swanston, Wm. Garstang, C. H. Cory, J. S. McCrum, Thomas Shaw.

These subjects are interesting, and are attracting the attention of some of the best railroad men in the country. Post up on these things, and let your officers see that you take an interest. Discuss the questions offered, and make suggestions—practical pointers often change opinions. Don't be so afraid of making a mistake—everybody makes mistakes. Don't be so afraid you will expose your ignorance—nobody knows everything.

Charles Bockwell has just died at New Haven. Over forty years ago he was employed by the N. Y. & N. H. road to write the tickets used on the line.

Sensible Overflow Nozzle.

Every man who has or does use a lifting injector on a locomotive knows what an intolerable nuisance the shower-bath attachment to the overflow is. This can be remedied by making a union coupling there, but then you have to look outside for the water. This you cannot do when overflow pipe is introduced into the ash pan. The Rue Manufacturing Company, of Philadelphia, who make the Little Giant injector, now send out an overflow cup for the pipe that won't let the shower-bath work. It is a short cup, slightly smaller than the overflow pipe, and has no taper. The pipe used is the same size as the water supply, and will carry off all that comes out of the nozzle. The old plan of delivering the overflow water to the waste pipe under pressure, and expecting a ⅜ pipe to carry off all the water from a ⅜ nozzle, was rather inconsistent.

The citizens of New York kicked so vigorously against the squeaking noise made by the chilled-face Lappan brake shoes on the elevated roads, that the management went back to soft cast-iron. The Lappan shoe lasts longer than two common shoes, but it will squeak. This would not be noticed on a surface road, but over the heads of thousands of people 3,600 trains a day were stopping every five blocks, and the thousands of people kicked.

An English Variable Nozzle.

The accompanying cut, for which we are indebted to our English contemporary, *Engineering*, shows a new form of variable exhaust nozzle now in use on the Great Eastern Road. This nozzle is the invention of Mr. George Macallan, manager of the road's general shops at Stratford, and Mr. Charles Adams, of London.

As will be seen, there are two hinged nozzles or tips, that can be thrown down upon the nozzle stand; when one is down the other is up out of the way, and there is provision for throwing them both up and leaving the large nozzle free to exhaust into the stack.

This plan gives a variable nozzle in three fixed sizes, and of such shape that they can be easily cleaned—clogging up has been the fault of all former attempts in this line.

The segmental gearing that provides for a partial movement of the hinged nozzles, and the holding of one out of position, without further movement, while the other is being operated, is very ingenious and is plainly shown in the engraving.

We are not aware how the blast and the coal used in England affects the exposed parts, but in this country the cinders, acting like a sand blast, would cut off the hinged nozzles and all the other exposed parts. This trouble could, in a measure, be helped by casting heavy projections below the hinges, and placing the operating gear outside the arch.

A saving is claimed for this nozzle when light trains are hauled, as the runner can increase the size of nozzle to prevent excessive steam making, instead of opening the fire-door or manipulating the dampers. The design is simple, and there seems little chance of its becoming inoperative from getting foul.

A Noted Bridge to Come Down.

Kinzua viaduct, on the Erie road, has long been a noted piece of engineering; it was built by the firm of Clarke, Reeves & Co., and was the highest bridge in this country, and, with one exception, in the world.

The structure is too light to carry the heavy traffic now being done on that division of the Erie, and it is to be replaced with a detour. Kinzua viaduct, which spans the gorge of Kinzua Creek, is 2,400 feet long and is 305 feet above the water. It was built for a single track at a cost of $237,000, and consists of twenty towers, each 10 feet by 38½ inches at the top, and of varying width at the bottom.

It carries a branch of the New York, Lake Erie & Western Railroad from the petroleum fields of Bradford County to the coal fields of Elk County, and was completed August 29, 1882.

[The above item has appeared in about two hundred papers, railroad and otherwise, within the past month. It is interesting and all right except in one particular—it is not true. The bridge is all right and will not come down.]

A Curse.

In no country but this could private individuals and firms hire a small army of toughs to protect themselves against interference by their employes, the public, or the civil authorities. Even Russia has no such curse as the Pinkertons. John Burns' speech before the Manchester workingmen, in which he declared that such an armed force in England would be torn limb from limb, their force met by force, and their bludgeons met by other bludgeons, has met with the approval of all England. The press generally declare that such a blight upon English civilization would not be tolerated. Whatever else is done about strikes on our railroads, the Pinkerton toughs have got to be dispensed with; they are trouble breeders, use their firearms upon a crowd, whether strikers or not, and the civil authorities of any city or any State that tolerate them for one day should be held responsible. The people have a right to resist the sword by the sword, and if no other relief shall come, workingmen have a right to arm themselves and meet the Pinkerton army in a war of extermination.

The Reason Why.

The cause of boiler explosions is an ever fruitful source of speculation. We thought we had heard everything mentioned to which they could possibly be ascribed, but here is a new one from the Pacific coast: "An investigation into the causes of the explosion resulted in the acceptance of the theory that it was caused by a leakage of steam from the hand-hole under the boiler. The air rushing in caused the explosion. There was only sixty pounds of steam on at the time of the accident."—*Power*.

Several large railroads, including the Baltimore & Ohio, Allegheny Valley, Western New York, and Pennsylvania, Pittsburgh & Western, Cleveland, Lorain & Wheeling, and Pittsburgh & Lake Erie regularly purchase and furnish to firemen Winterton's metal polish. This polish has a good reputation among enginemen who buy it largely to save themselves work, but it is far better, and will be used more, where the company pay the bill.

Erastus Winan has proposed to build a tunnel from Staten Island to Long Island, under New York harbor, and a company has been formed for that purpose.

James Nasmyth, the inventor of the steam hammer, left an estate valued at a million and a quarter.

A great tunnel is proposed between the north of Ireland and Scotland.

Keeping Data.

One of the most interesting things for a railroad man is an old note or memorandum book kept by some railroader with a natural bent for figures and sizes

The sizes of different parts of locomotives have been greatly changed in the past decade, sometimes being an improvement and sometimes not. It is only by comparison that we can keep track of improvements and the progress made.

Sometimes two roads, or the same road, put in service engines alike, except in one particular; this may be slight and of any nature, from an inch difference in wheel centers to two feet difference in grate; it may be only half an inch more length to the driving-box, two inches difference in port, in one or the other, or any such difference, and it is interesting and highly instructive to watch, for a number of years, the difference in service rendered or cost of repairs.

Changes are often advisable for one cause or another, and where a lot of sizes and designs of other roads are at hand, possible changes are suggested that have the advantage of having passed the experimental stage.

Draftsmen and foremen of shops can, and generally do, have blue prints on a small scale, giving most of the data concerning each class of locomotive in the service, but this usually covers but the home road.

What is wanted is some form of data that can be used by engineers, firemen or shop men to keep up data in a uniform style and in shape to be easily referred to.

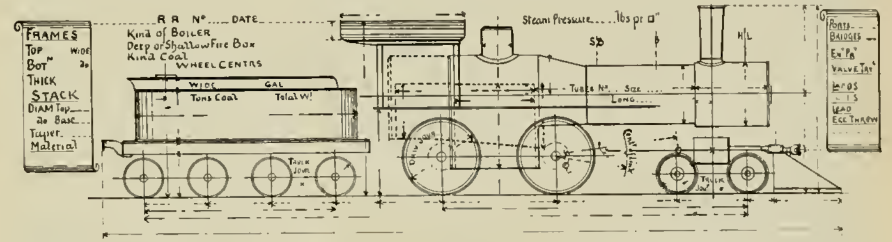
About the best plan we have run across is the one used by Lewis R. Pomeroy, of the firm of Coolbaugh, McMunn & Pomeroy, of this city. Mr. Pomeroy has got up a set of tracings for prints with the outlines of an engine of each class and blanks to fill out; this, in book form, is easily carried in the pocket, and, when visiting a road or shop, dimensions are easily picked up; perhaps but a few of those given on the blank are secured, but all are useful.

By copying general dimensions of engines given from time to time from railroad papers, data is kept together in such shape as to be easily referred to, and the cost is slight.

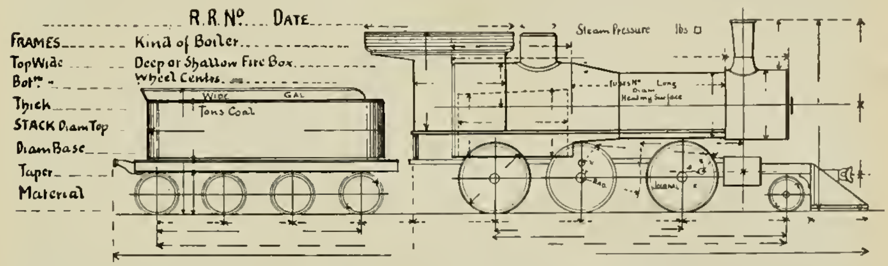
His outline sketch of an 8-wheeler, shown here full size, has dimension lines on the drawing itself for the principal sizes, and it will be seen that the full lines show a short, deep fire-box, placed between the frames, while a long fire-box on top of the frame is shown in dotted lines. If dimensions are for the latter he simply draws in full lines over the dotted ones, and thus makes one outline for both kinds of 8-wheelers.

In the same way the mogul can be changed more or less, it being understood that pencil lines over the drawing are to be taken for the true outline.

Mr. Pomeroy has a composite outline for 10-wheelers and consolidations, which we will publish at another time.



Boiler Material ..... Thickness.
Fire Box x x Flue Sheet Crown
Back Sides Water Space Sides Back
Method of Staying
Grates, kind x Area
Ash Pan
Arch supported by
Heating Surface Fire Box Tubes
Total
Guides Crosshead
Wrist pins .....x Crank pins x
Links
Springs, length Hung
Truck
Weight on Drivers in working order lbs
" " Truck lbs
Weight on Total in working order. lbs
" " Tender " lbs
Spread of Cylinders (centers) Frame
Valve Travel Bridges x Ex. Port....x...
Lap o s ..L s . Lead. Ecc. Throw
Remarks .....



Boiler Material . ....Thickness Side Sheets.
Flue Sheet . Back . .Crown
Fire Box in long in wide in deep .
Water Space in front in sides in back.
Method of Staying
Grates, kind Area
Ash Pan
Arch supported by
Heating Surface ..in Fire Box.. Tubes
Total
Guides . Crosshead
Wrist Pins .Crank Pins
Links, kind Dimensions
Springs, length Hung
Truck, kind
Weight on Drivers in working order lbs
Weight on Truck in working order. lbs
" " Total " lbs.
Weight of Tender " lbs
Spread of Clylinders (centers)
Spread of Frame
Remarks

Many mechanics and enginemen have kept a great deal of data of this class heretofore, but it is very hard to find in an ordinary diary, while this plan furnishes a great deal of information with the least possible amount of writing.

Down on Attorneys.

The Western Railway comes out strong in favor of railroad officials refusing to meet any but employes of the road. It makes no difference whether the representative of the men is an employe or not, so long as he is the accredited representative of the men—the railroads employ attorneys to represent them. We don't like the "walking delegate" plan, or the committee of trouble soothers, but they have a right to exist and be heard just so long as they are sent by the men. Professional grievance hunters are dangerous; when things are wrong a special committee representing the men is fresh, comes from headquarters, and are not, as a rule, as offensive as professionals. Standing grievance committees in times of peace are a constant menace to peace. If everybody followed Bro. Warman's advice it would kill off all the lawyers—or set 'em to sawing wood.

Big Engines for the St. Clair Tunnel.

The Baldwin Locomotive Works, Philadelphia, have the contract for building four decapod tank locomotives for service in the St. Clair tunnel. These engines are to have cylinders 22x28 inches, five pairs of driving wheels 49 inches in diameter outside of tires, and will weigh, in working order, including 1,800 gallons of water in the tank, about 180,000 pounds. They will have boilers 74 inches in diameter, carrying 160 pounds steam pressure. The fire-box is 11 feet long by 3½ feet wide. There will be about 280 tubes, 2¼ inches in diameter and 13 feet 6 inches long. The cab is placed centrally over the boiler, with foot-plate and coal-box at the rear of the boiler. The wheel-base is 18 feet 8 inches. As the track through the tunnel is straight, the engines are not required to pass curves on the main line, and are only required to enter ordinary sidings. Additional play will be given the tires of the extreme driving wheels. The second and fourth pairs of driving wheels will be flanged with the usual play, and the distance between their centers is 8 feet 9 inches. The tires are to be secured by Mansell retaining rings, and each engine will be fitted with two sand-boxes and two headlights, a Cooke steam bell ringer, and the Westinghouse automatic brake, with equalized driver brake fixtures acting on all the wheels. The fuel will be anthracite coal or coke. The load which these engines are intended to haul is about 760 tons, and the grades are 105.6 per mile. They are to be delivered in January.—*Railroad Gazette*.

These locomotives will have the largest boilers carried on wheels—6 feet 2 inches in diameter.

Steel rails are worth $31 per ton in New York. Old rails have sold this month as high as $26.

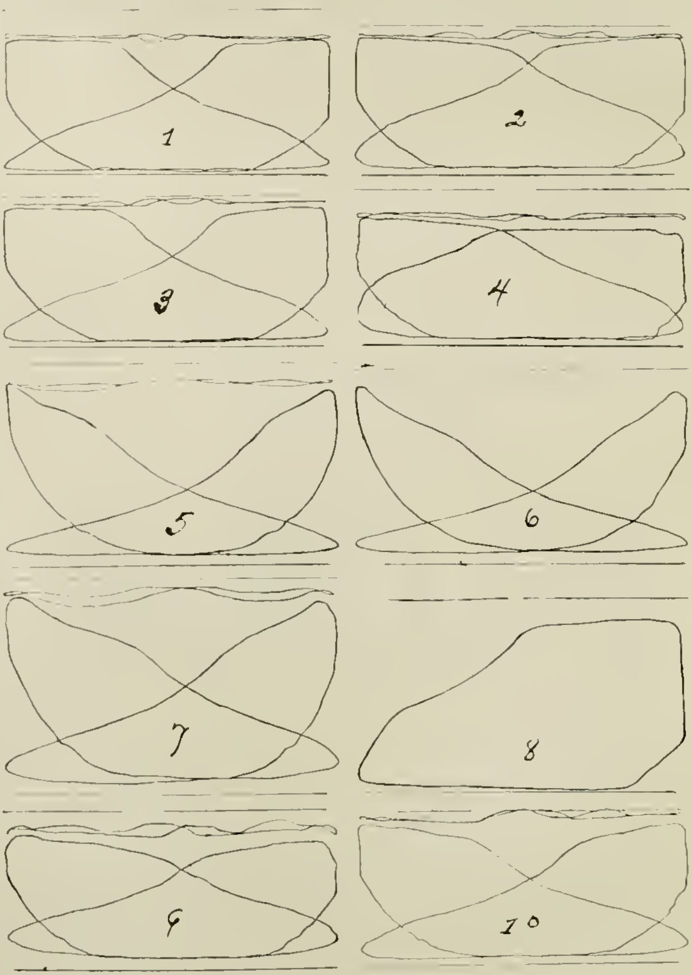
Some Every-day Indicator Diagrams.

As a usual thing, when indicator cards are given out for publication they are about as nice ones as can be had, and considerable allowance has to be made when you come to figure on the general practice of the whole road It is, therefore, considerable satisfaction to get a look at cards not intended for outsiders, and taken at random from an engine; not to test her valve gear, but to hunt for leaks in another direction.

The accompanying cards were taken from consolidation engine No. 583, on the Richmond & Danville road, by Mr. A. W. Gibbs, M. M., at Alexandria, Va. They were taken to see if the Smith triple expansion exhaust pipe had a tendency, as had been charged, to increase the back pressure, and to cause an excessive "hump" in the card, when starting, due to the pressure in the exhaust nozzle of steam from the opposite cylinder—a common fault with single nozzles.

Some thirty cards, from which these were selected, were sent to Mr. Smith by Mr. Gibbs, and in a note under date of June 16th he says:

"I send you herewith some cards taken from engine 583, but I do not consider them as good as should be; we can do much better. I am not particularly anxious to advertise these cards as the performance of R & D engines, owing to a light train necessitating a light throttle. This engine has cylinders, 20"x24"; drivers, 50" diameter; steam ports, $16''\times1\frac{5}{8}''$; exhaust ports, 16"x3"; travel of valve, 5"."



Mr. Smith sent us these cards to show us how ungrounded were the claims of excessive back pressure, and we publish them without asking leave or consulting anybody.

However, Mr. Gibbs has nothing to be ashamed of in these cards All of them were taken from the left cylinder, the engine being on a local freight train of 22 loads. The cards are exact size of originals.

No. 1 was taken with the boiler pressure at 142 pounds by the gauge; revolutions per minute, 60, scale of the spring, 100; and shows a mean effective pressure of 68.9, and an indicated horse-power of 314 59.

No. 2. Boiler pressure, 137; revolutions, 80; scale, 100; M. E. P., 79 4, I H. P., 483.9

No. 3. Boiler pressure, 137; revolutions, 48, scale, 100; M. E. P., 71.4, I H. P., 258.

No. 4 Boiler pressure, 142, revolutions, 78, scale, 100; M. E P., 77 9, I H. P., 455.3.

No. 5. Boiler pressure, 147; revolutions, 130; scale, 80; M E. P., 47 6; I. H. P., 470.9, throttle quarter open, lever in 15th notch.

No. 6. Boiler pressure, 142; revolutions, 200; scale, 80, M E. P., 42.2; I H P, 642.28

No. 7. Boiler pressure, 157, revolutions, 179; scale, 80; M E. P., 62; I H P., 827.2

No. 8 Boiler pressure, 150; revolutions, 40; scale, 80; lever in corner, throttle half open—a splendid starting card. The way the card approaches the atmospheric line just before the exhaust port closes and compression begins, shows there is no tendency of the exhaust from the other cylinder to put back pressure upon this by temporarily choking the exhaust tip; this card must have been very gratifying to Mr. Smith.

No. 9 Boiler pressure, 147; revolutions, 114; scale, 100; M. E. P., 67.5; I H. P., 585.5.

No. 10. Boiler pressure, 142, revolutions, 113; scale, 100, M. E. P., 66.5; I. H. P., 571 8.

For cards taken from a heavy freight engine, being chain ganged early and late, we doubt if these do not show a condition of motive power considerably above the average.

Metal vs Wooden Ties.

Metal ties have not yet been designed that are as good as oak: they are too rigid, noisy, and act as anvils under the rail when the ground is frozen. Those philanthropists who are worried lest the railroads of the United States shall use up our forests for ties, might turn their attention to the northern half of North America, where there is standing hundreds of square miles of available timber—enough, surely, to last this continent until a second growth shows up—what is the matter with using this? As it is, there is a high duty on timber, and Canadian choppers are imported to cut down our own forests The latter can be saved, ties cheapened, and American workingmen not disturbed by removing the import duty. Facts are stubborn, and will finally be seen—this is a fact.

The average car axle-box, wreathed in a cloud of smoke and a smell of decayed mule, rattling along over the country, without a cover, and with a great gob of greasy waste soaked full of dust hanging out of the box—without touching the axle—is about as unmechanical, dirty, careless, trampy-looking a thing as our railroads have, and ought to be ashamed of.

The Pittsburgh Locomotive Works are building some 19x26 ten-wheelers for the K. C., Ft. S. & M They will have Dean guides.

The nominal capital of the railroads of this country, represented by stocks and bonds, amounts to the enormous sum of $8,518,718,677.

The Valve Gear of the Ross Winans "Camel" Engines.

Last month we illustrated one of the "camel-back" engines built by Ross Winans, of Baltimore, more than thirty years ago. These engines were original in almost every particular, the valve motion being no exception. The cut-off mechanism was peculiar in that it worked steam expansively while all the time operating the valve its full stroke, and it is claimed by many engineers that it was the nearest approach to an ideal cut-off ever made on locomotives, using as it did but one valve, and being particularly simple. The valve motion of the day was the drop hook, and this Winans adopted, and added the cut off. Across between the frames of his "camel," just in the center of the wheel-base, was a shaft on which were the two rockers—one for each side. These rockers, shown in Fig. 1, had a curved arm that extended over the wheels and terminated in a bearing for the back end of the valve stem, as shown at *P*; on top of this curved arm was cast a socket, shown at *S*, for inserting the starting bar when necessary. The shaft went through the body of the rocker, as shown by the dotted lines; below the shaft there were four arms carrying at the bottom a steel pin or bolt that extended through them all, forming three bearings as shown at *D*, *D*, *D'*, Fig. 2. Now there were two eccentrics on a side—one set for the forward and one for the backward motion—these eccentrics operated drop hooks, each having its own place in the lower end of rocker. Then, beside the eccentrics, there was a cam, as shown in Fig. 2, operating another hook This cam worked in a square frame or yoke *Y*, as shown, the frame being suspended from the boiler by the hanger *L*, and it operated a hook *H* exactly like the drop hooks of the eccentrics.

The reverse lever merely tumbled the shaft *T*, and this shaft carried six cams like *C*, three for a side, each cam being under a hook When the lever was in the center, or "out" notch, all the cams were turned enough to lift the hooks clear of the pins in the lower arms of the rocker, and the valves would not operate while the hooks worked back and forth, sliding on the cams. If the lever was put into the back-up notch the cams under the back up hooks presented their low sides at the top and the back-up hooks would fall down and engage the pin *D'*, and operate the back-up gear.

If the lever was put in the forward notch the back-up hooks were lifted, and the forward motion hooks dropped into gear.

Ahead of the forward motion notch there was another, for the cut-off, and when the reverse lever was dropped into that, both forward and back motion hooks were lifted out of gear, and the hook of the cut-off cam dropped in.

There was a guide, or yoke, under each hook, to prevent the top from striking the rocker, and to provide a rest for the hook to slide on when out of gear. These hooks had nothing to hold them in gear but their own weight, and the friction, in forward motion, and once in a while in backing up, if the eccentrics got dry, they would unhook. If the engine was standing still and out of gear, or it was desired to change from forward to back or *vice versa*, the hook that was out could not be engaged with the pin *D*, so a starting bar was dropped into the socket *S* on the rocker, and the rocker moved until the hook engaged the pin, then the bar was taken out and set into a stationary socket provided for it.

The "four motion cam," as it was called, was so shaped that it filled the frame *Y* in every position, so that there was no knock. It caused the valve to travel five inches, just as the eccentrics did, but the valve stood still twice during each revolution. When the pin, which is shown at *B*, was at the dead center, the valve was opening very fast, and opened wide almost instantly, and closed with a quick motion when the pin reached the quarter, here the valve rested, allowing the steam to work expansively, while at the same time holding the exhaust open for the other side, until the piston had traveled nine-tenths of the stroke.

The exhaust, of course, was just as sudden as the admission, and produced a very sharp and intermittent blast on the fire, which was generally believed to be the cause of the camel engines being so hard on fuel—no great difference being noted in the amount burned between the cut-off at quarter stroke and the hook at full stroke.

These engines with very small ports and short valve travel did exceptionally good work with low-pressure steam. With this valve gear an engine could break her forward eccentrics or her cut-off cams, and yet go along with her train; and we are told of one man who broke the cut-off and forward motion eccentrics, but got his camel turned around and took his full train to its destination, backing up.

The sketch of this cut-off motion was made by Henry F. Colvin, general manager of the Rue Manf'g Co. of Philadelphia, who used to haul coal with a "camel," away back in "the merry old times that were."

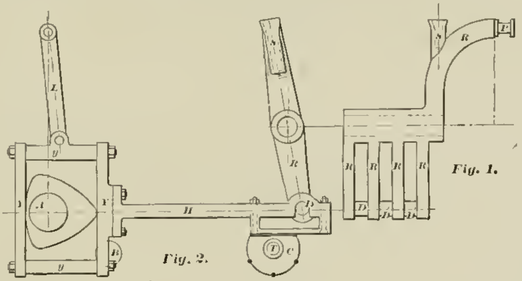


Fig. 1. Fig. 2.

Valve Motion of the Camel-Backs.

The Big 4 road has issued an order against the draping of engines or cabooses when men are killed in train service. This is the rule on several roads now.

In England the Board of Trade regulations call for the printing of the price on all railroad tickets.

Four Signal Plans.

An exchange describes a "permissive" block system adopted on the Erie, between Geauga Lake and Mantua, as follows:

There will be two "blocks," one extending from Geauga lake to Aurora, the other from Aurora to Mantua. The system adopted is "permissive." When a passenger train is on a block no other train can enter that block except in case the wires are not working, when a second train may follow fifteen minutes after the first. A freight train may follow a previous freight after a 10-minute interval under a caution signal

If this description is right, the "permissive" block system would appear to be almost as good as no system at all. The plan of following a train after the lapse of a certain number of minutes is the usual plan, and no signal system is of any use that uses it—you don't want to know how long the preceding train has been gone, but where it is.

The Central of N J have put up an electric search light on the signal bridge at the tower in the Jersey City yard. It gives a very bright and penetrating light, and may be a nice thing for the men in the tower to turn into the station, or on the yard, to note the condition of things, but after an engineer has looked at that he won't be able to see a signal, or even the station, for ten minutes.

The Dickson Locomotive Works, at Scranton, have delivered thirty heavy locomotives for use on the new line of the N. Y., Ontario & Western, known as the Ontario, Carbondale & Scranton.

Santa Fe Notes.

John Player is quietly rattling up the dry bones on the Santa Fe. He is a progressive man and a man of resources; he has hold of a collection of grotesque mechanical standards and the motive power plant of the longest road on earth. His first move has been to indicate the engines as fast as they come out of the shop, with the result that many went back and had their exhaust ports widened and the passages straightened out, with a very perceptible benefit. Some of the engines indicated, when cutting off at eight or ten inches showed excessive compression—before the piston had completed its stroke by two or three inches—above that in the steam chest, although the valves were line and line. On most of these a remedy was had by simply making the exhaust closure later, and in others a marked increase of power was obtained by increasing the clearance. The general shop at Topeka is being fitted up with a complete grinding department, grinding is an art that our American railroads have neglected. One man in a well-fitted grinding room will do as much finishing as half a dozen with old methods; keys, straps, nuts, bolts, guides, etc., can be finished quickly and neatly in this way—the Pennsylvania Company brighten their pipes for hand rail and like work on grindstones at a very slight expense

A compressed air plant will be put in, and with small engines on tracks such work as cylinder boring, valve facing, drilling, etc., will be done cheaply and with expedition, it is also the intention to provide all heavy machine tools with cranes operated by air

The Santa Fe is almost too big for one man to handle, the power is scattered over 8,000 miles of single tracks, and shops are located more than 2,000 miles apart; he who succeeds with it will be an organizer—not one of those who personally see to everything, like a peanut vender, but one who gets things in something the shape of an 8 day clock—just needs the touch of the key occasionally. Mr Player has a good reputation for push, and he has a great big chance to exercise that propensity where he is now.

The Santa Fe road have some bad water, and are at present experimenting with a view to separating the solids by a live-steam heater. This arrangement is located between the injector and the check. Where the trouble is principally from lime, there is little doubt that a live-steam heater does the best, but whether this should be carried upon every locomotive or located at each water tank is a question. We are inclined to think where the trouble is great that the latter plan will be the best and most effective, although there is not, at the present writing, a device on the market that just fills the bill.

The accident on the Reading last month, in which twenty-one lives were lost, was caused by a pile up of coal cars from a train breaking in two. This wreck covered all the tracks, and had barely taken place when a passenger train dashed into it—on another track—with the terrible result stated The flagman of the coal train is blamed. The wreck occurred on a curve; we fail to see how a flagman is to know that all tracks are blocked when the train stops suddenly. This road haul as high as a hundred coal cars in a train, coupled with hook and chains with more than a foot of slack to each car. A collision at the head end has something the same effect on the caboose that would occur if the engineer pulled the engine over. Were all the coal cars equipped with automatic air-brakes there could be no pile ups from breaking in two

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Where the rails are used to operate electric signals or crossing bells, it is necessary to insulate the wheels of hand and push cars so that they will not operate the signals. This is done by using a wooden wheel center

Some Early Valve Motions.

PLAN WITHOUT ECCENTRICS.

Early builders of locomotives were afraid of eccentrics, claimed they were, at best, weak, and it was hard to get movement enough with them, and several builders in foreign countries tried to devise valve motions that would do away with them.

One of the earliest of these was the plan of Hawthorn, a builder of some note

He took his motion from a pin on the main rod, something after the plan now used in the Joy gear. See illustration.

Supported on a stationary link at the bottom, and the long arm of the bell crank *D* at the top, was a slotted frame *C, H*, and in this slot the pin on the main rod worked, having a roller upon it to prevent excessive wear The movement of the main rod, up and down, caused this frame to vibrate the bell crank at the top; this crank had an extension above its fulcrum at *E*, and a bearing pin there for the hook to engage, it is perfectly plain that when this top pin moved in one direction the lower pin *F* would move in the opposite direction, and the engine was reversed by lifting the hook out of engagement with one pin, and upon the other, by the system of levers shown

The movement of the rod is not alike at each end of the stroke, but the inequality was corrected by adjusting the length of the lower link, and the short lever *L* and by getting these right the lead could be equalized.

This gear could only be used on slow-motion machines cut off only at one point of the stroke, and its disadvantages are obvious; it was, therefore, short lived.

A New Crosshead Jack.

Stebbins A Teal, of Missouri Valley, Iowa, has recently been granted a patent on a screw crosshead jack, of which the accompanying cut gives a good idea.

As will be seen, the body of the jack carries a short plunger or ram *G*, that is moved out by a wedge behind it The back of this plunger is rounded off where the wedge comes in contact with it so as not to bind, and is prevented from turning by a dowel pin that extends into the slot shown below the letter *G*; the wedge is a round pin *D*, flattened off tapering; it is prevented from turning by the dowel *F*, and is lifted up by being connected to the main screw *B* by a swivel nut *E*. The body of the jack has a slight depression at *A*, to enable it to rest securely on the crosshead pin, against which it rests when at work forcing out the plunger *G*.

This jack is small, easily made and kept in repair, and can be used in cramped space

The largest grain elevator in the world is at Minneapolis Junction, Minn It is 366 feet long, 92 wide and 175 high, with a capacity of 2,000,000 bushels. It can handle 200,000 bushels per day, and has loaded 250 cars of wheat in ten hours.

The D., L. & W road had a boiler explosion a few days ago; the barrel of the boiler was stripped off the flues from the wagon-top to the front course. The engine, the 25, was an old wagon-top with flat sides on the fire-box and the taper sheet—a weak point. Three men were in the cab, and though the engine was derailed, no one was seriously injured.

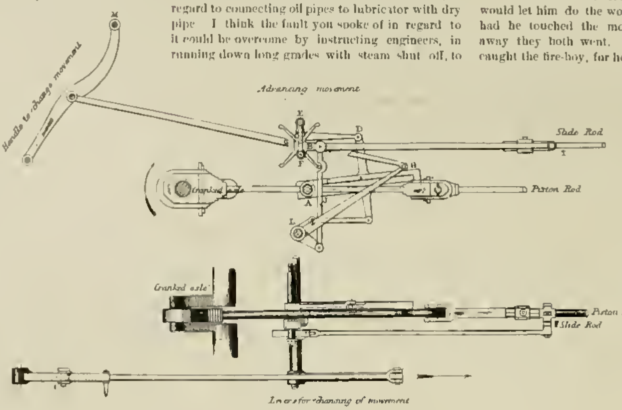
Correspondence

Another Argument Against Connecting Lubricator to Dry Pipe.

Editor The Locomotive Engineer

I see an article in September number of THE LOCOMOTIVE ENGINEER from Allen Wood, M M., in regard to connecting oil pipes to lubricator with dry pipe I think the fault you spoke of in regard to it could be overcome by instructing engineers, in running down long grades with steam shut off, to open throttle valve every few miles, and give a little steam—enough to drive oil from dry pipe into cylinders I think there is another objection to connecting oil pipes in the way mentioned. If it was necessary to put engine in back motion in order to stop, and she ran long enough to pump up more than boiler pressure, the oil would be forced from dry pipe into boiler and cause engine to foam.

Altoona, Wis IRA F. WALLACE.



EARLY VALVE MOTION.

Electricity on a Locomotive.

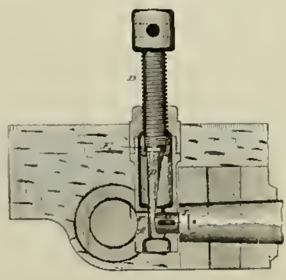
Editor The Locomotive Engineer:

I see an article in the August number of THE LOCOMOTIVE ENGINEER from Old Timer, Baltimore, Md, asking if any one ever experienced any electricity when engine was blowing off steam. Seeing no one made a reply in September number, I will give a little of my experience in regard to it I think it was five years ago this coming winter my engine came out of shop. I started out one cold, still night, on a freight train. I noticed she did not carry standard pressure of steam.

We ran about thirty miles, when we had to take siding for a passenger train, and while waiting thought I would go and try my hand at setting the pop. I took monkey wrench and started on hurricane deck to do the job. The engine was blowing off steam at the time. I gauged the wrench to other pop and then applied to one blowing off steam, or tried to; for no sooner had I touched the metal with wrench when away went Mr. Wrench and Mr. Engineer. Mr. Wrench went out in snow, and your humble servant on his back on top of cab. For an instant I did not know whether I was blown up or struck by lightning. After I regained my horse sense I shouted to fire-boy to fish the monkey wrench out of snow somewhere around engine. He found it, and I told him to come up and help me. This time I held the torch and told him to screw her down. (Thought I would let him do the work this time.) No sooner had he touched the monkey wrench to pop then away they both went. I dropped the torch and caught the fire-boy, for he was going to follow the monkey wrench this time. I could not keep from laughing if it had killed him. After he regained his speech he says to me, "You think you're d—— smart, don't you?" and he looked cross-eyed at me all the rest of the trip.

After she stopped blowing off I got up courage to try it again, and succeeded in setting pop all right; felt no more electricity, but our arms were lame for two weeks after it. I thought of speaking to some expert electrician about it, and get an explanation as to cause, but neglected to do so, and am in ignorance yet in regard to cause of it. Who can explain?

Altoona, Wis IRA. F. WALLACE, Eng'r C. St. P., M. & O. R'y.



CROSSHEAD JACK.

Side Rods.

Editor The Locomotive Engineer:

Have been reading an article in the *Car Builder* for September about "Side Rods and Crank Pins" The subject is well handled from a mechanical standpoint, and will be of service to many. The writer fully agrees with its many good points which are shown up, but it appears to some that the entire cause for breaking is not poor workmanship in shop, neither is it all due to wheels being ⅛" larger or smaller than should be. If side rods only broke from duty that should be required of them there would not be *one* broken where there are now *fifty*, and my object in calling your attention to this matter is, it is quite possible for it to be brought to the notice of many who do not see the *Car Builder*, and also to get another class, who are more interested in this subject than any one else, *i. e.*, the engineers, who can do much to assist the mechanic in doing away with this evil. It ought to be thoroughly understood by everybody interested that the duty of a side rod is to convey the surplus power from the main wheel to rear wheel (am now speaking of a standard American type of eight-wheel engines), which only occurs when front wheel fails to give the amount of adhesion required for work done, and in no case can this surplus power be more than one-half of cylinder power of engine, which shows it is not excessive, for it is very common practice now to find engines with very small main rods, which seldom give any trouble. Why side rods break, straps give out, and crank pins drop off, in nearly all cases is the *undue strain* brought upon them by not being the *proper length* or not having a sufficient amount of *lost motion* to adjust themselves to the varied conditions under which they are compelled to perform their work. These varied conditions are brought about by the several different parts of the engine, which come directly in connection with this matter, *i. e.*, the driving-boxes, wedges, axles and crank pins. When an engine is new, or just out of the shop, there is not any trouble to know how to have side rods put up that will not give trouble, either in running or breaking. A good way to put them up and know they are correct is to have the engine standing on a level track, with both driving-boxes in same position in pedestal, *i. e.*, same height from frame; then fit rod on to each pin so it is a good running fit. After this is done the rod should be taken off, and one pair of wheels raised up until the driving-boxes come to the frame, and the other boxes come down to truss braces at the bottom of pedestal; then the rod should be put up against the pins and see how much short it is; when this is found the brass should be filed out to allow the rod to go on in as free a manner as if that was to be the position that they were expected to run (and this last measurement should be taken when engine had steam on, so that all expansion could be had). This will make the brass in back end of rod elongated to whatever extent the two measurements differ in length, which will be enough to set many a good man to thinking how it was possible that he had never broken more side rods when put up as they are many times. When making this back brass elongated, do not make it any wider than diameter of pin, and there will not be any rattling of the rods, such as one often hears where the solid end is used, and which is very annoying to some, while it is fine music to others, who have thought it best to go back in the tank on occasions when side rods had broken. And now this is all that need be said on this subject, if the engines did not wear while in service; but they do, and this wear must be compensated in some way; the driving axles will get smaller, and the brasses in driving-boxes get larger, wedges get slack, wear more in one spot than another; and pins do not always wear to keep true with their centers.

Each one of the above aggravates the trouble, and a good way to do is to allow whatever wear there comes to the side rod alone until the wheels, boxes, pins, wedges, etc., are all put right again when in shop. There are engines of recent build running, that have their side rods so constructed that whenever a key is driven it changes the length of the rod, which in nearly every case will shorten it when it ought to be longer. Go around any engine house and find the man that does the fast running, his engine is getting towards a point where it will go to shop in a short time; its boxes are bad, wheels need turning, axles want truing up; in fact, "all to pieces." He feels like doing something to keep going as long as possible, so he will "line up side rods" and have them right, even if the rest is bad, it being the only thing he can do, and he feels as though, if the engine does give out with him before going in shop it will not be his fault, for he has done whatever it was possible for him to do, and he is strictly honest in so doing. But if one will hunt up the breaking of side rods he will find that very many of them are broken at about the time these things occur, *i. e.*, when the engine is about ready to go in shop with some one who is doing his level best to get a little more out of it. There is one thing that all engineers, more particularly those running fast trains, should always keep uppermost in their minds in regard to side rods, and it is this: There never was a side rod broken on account of running with "too much lost motion" in them. It is the want of the proper amount that produces the undue strain upon them that metal can only stand for a time. There is not any doubt but the solid end rod, made with I section, is the best one in use, but it is not as much due to the section as it is to the solid end, which does away with much of the "monkeying" that is too often the case with other types of rods.

If this will be the cause of a few of the many who see it to *think*, the writer will be fully compensated. R. W. CAMEL.

Baltimore, Md.

Big Engines and Longer Hours

Editor The Locomotive Engineer.

I see in THE LOCOMOTIVE ENGINEER of September that Brother Andros comes down some, and admits that big engines have a tendency to do up engineers in some cases. I never kicked against them on account of reducing the number of men. What gets me is that I must haul twice the number of cars, use twice the amount of sand, and put twelve hours to make a trip instead of eight as I used to do.

This is what I call being done up. I never thought of asking the company to buy me a toy engine to run. Neither did I think of telling them that a sixty-ton engine is better than a forty-ton engine for all concerned. When I make up my mind to write for the interest of the public instead of the engineer, who does more work for the same money, then I will sign my own name.

Baltimore, Md. OLD TIMER

[When a locomotive engineer puts twelve hours in where he formerly put but eight, his pay should be increased accordingly. Engine men are already on duty much too long for safety.]

The First Locomotive in America.

Editor The Locomotive Engineer:

Some time since you told us that the first locomotive in America was the "Stourbridge Lion," and that she ran on the D. & H. C. Co.'s road at Honesdale, Pa. The school history of the U. S. states that the first locomotive was put to work upon the South Carolina road, and now Mr. Hemenway says Hero, of Alexandria, constructed the first steam engine 2,000 years ago.

Now which is which? A. F. COOK.

Lilly Pond, Ga.

[All are right. Hero made the first steam engine (not locomotive); it was a mere toy. The "Stourbridge Lion" was imported from England and was the first locomotive to turn a wheel in America, while the "Best Friend" was the first locomotive *built* in America, and she first ran upon the South Carolina road. There were a number of locomotives in use in England before the "Stourbridge Lion" was steamed up.]

Slipping.

Editor The Locomotive Engineer:

I have read all the articles on the cause of locomotives slipping when running down hill with steam shut off, and the many theories advanced to account for it. In my experience of six years on the footboard I never knew of one slipping in that way, or heard of it, until I read of it in your paper.

W. F. Relyea, on page 166, says the axles of Engine 121 were twisted, and that she does not slip ahead since getting new axles. Now I would like to ask Mr. Relyea how he accounts for both the main and back axle being twisted alike. Does he claim that the pins and side rods are stiff or strong enough to stand the strain to twist the back axle, even if there was power in the cylinders to twist the main one?

I am like "Hogbacker"; I would like to ride on an engine once that turns her wheels fifty miles per hour, when running twenty-five with steam shut off. FRANK PHELPS.

Ft. Hancock, Tex.

Use of Copper Fire-boxes in America.

CARELS BROS. LOCOMOTIVES AND STEAM MACHINES.

Editor The Locomotive Engineer:

We beg to ask for answer as soon as possible in one of the next issues:

What is the metal generally used in America for locomotive fire boxes—copper or steel?

Do you know such companies of railroads who have employed steel fire-boxes for locomotives, and leave them out after, and the causes of this?

Apologizing for the trouble and thanking you beforehand. CARELS BROS.

Gand, Belgium.

[There are probably a few copper fire-boxes still in existence in this country, but very few, if any, have been built in the past fifteen or twenty years. Steel is the metal generally used, and is probably put into nine-tenths of all locomotives built for use in this country now. No builders or roads here ever went from steel back to copper, but some did go from steel back to iron, but this was before steel plates were brought to their present perfection. First class fire-box iron is now more expensive than steel. Steel fire-boxes are a success in every way, as long years of service have abundantly proven.]

Pull of Reverse Lever.

Editor The Locomotive Engineer:

The cause of reverse lever jerking, and my understanding of it, as I have had the same trouble, I think it is caused by the link wanting to slip up on the link block, from the fact that, in running at a high speed shut-off, and with small drivers, the vibrating motion of the link is so quick that it does not overcome the inertia of the valve and other moving parts of the valve gear, which gives it a tendency to climb up on the block, and, of course, it transmits motion to the reverse lever through the hanger and tumbling shaft.

Having a balanced valve would make no difference when not using steam, as the load would have to be moved under all circumstances. With the short eccentric rods of most ten-wheeled engines the case would be more aggravated. Think one cause of the lever being hard to get out of the corner is the friction of the four eccentrics trying to keep the link down. We all know that the reverse lever wants to lean the way the engine is running, and it offers strong objections to a contrary position. I offer this as a theory, not as a fact.

In regard to the driving wheel slipping ahead, let us accept the theory of the counterbalance as one of the causes; but is it possible that there may be one small wheel in the lot, and the rail acting as a driver, the small wheel as the driven, and that the counterbalance has the wheels on the point of slipping, the quick motion of the smaller wheel will furnish the shortage, and start them all to revolving faster than the engine runs. Now, if this theory is correct the engine would slip easier with the main rods down than with them connected. Have fell down a hill pretty fast at times, but never noticed this peculiarity about my engine, as I was giving my attention to good jumping ground.

Corry, Pa. W. DE SANNO.

Improving the Service—A Little Experience.

Editor The Locomotive Engineer:

I have always taken an interest in your paper, because in it I recognize the means of picking up information—the experience of other men in the same calling. Thousands of engineers and firemen, shop men and officials now read the paper, and generally seem to want to extend its circulation, but I don't think they are as free to ask questions or advance arguments as they should be—only the *exchange* of information is fair. I have been thinking for some time that the railroads are pretty fair with engineers, and pay us promptly and fairly well, so we should give as good service as we know how. It is almost entirely in the hands of the engines' crews whether economical performance shall be rendered or not. I came to the conclusion that it was *drops* of oil that filled the big can, and *lumps* of coal that filled the tender, then I commenced to be careful of the *drops* of oil and the *lumps* of coal. I oiled as carefully as I could, taking pains to get little or nothing on the *outside* of the bearing, and watching the wastes; if I got up on the engine and found a lump of coal in the gangway, instead of kicking it off on the ground I threw it back on the tank.

Don't try to save *tank* loads of coal or *gallons* of oil—just *lumps* and *drops*—and you will be surprised to see the difference on the performance sheet. Just try it.

I also think that the right thing for an engineer to do when he has a very light pulling train is to say so, and offer to take a heavier one, if there are cars to go, and not kick and roar when the conductor pulls the pin to pick up an empty. I know this will not be seconded by many—they have been raised the other way—but why is it not the right thing for engineers to do just as they would for themselves? If we got our pay *per ton per mile*, as the company does, we wouldn't go over the road light.

A man that is known as one who wants to do all he can will not protest in vain that his train pulls too heavy to take on more cars, while the one known as a general kicker can't get his judgment accepted, right or wrong.

St. Paul, Minn. J. J. LEIGHTON.

About Engineers, Their Duties and Their Pay.

Editor The Locomotive Engineer:

Our friend J. J. Clair seems to be somewhat offended about my racket on valve motion, but he is off the track bad.

I am an old fireman runner, and there is no class of men I respect more than the locomotive engineers, but he knows as well as I do that we have men among us that imagine they can improve on any kind of work that may be done on their engines at the shops.

As to lost motion, I do not approve of it any more than he does, but I do assert that I can set a valve, and with lots of lost motion still make her beat square.

As regards the pay of my engineers, we pay the same on this road as standard gauge, and if you wish to know my sentiments on this, I do not think it enough. Engineers are worth more money than any class of railroad men, but they should fully fill the duties of engineers, and when they do this they always make money for the companies.

Furthermore, I am one of those that think the more money paid my men the more I will get for superintending the work. I allow my engineers thirty cents for every hour delayed, even if only one hour.

I hope this will convince you that I am not a "Cheap John."

Now, Mr. Clair, you must not forget that you are not the only man that takes this paper. Mill men, coal roads, and a good many private individuals own locomotives, and as they will want their engines to beat square I tell them how to do it without taking eccentric blades down.

I did not tell this expecting engineers to try it.

Houston, Tex. E. A. CAMPBELL.

A Splendid Specimen that Should Have Been Preserved.

Editor The Locomotive Engineer:

Few men would care to live their erratic lives over again, but if it were possible, the writer hereof would like to make amend for one bad job. Away back about 1854, while a cub at the machine shop of P. F. Geisse, Wellsville, Ohio, I had the very questionable honor to be appointed, together with another boy, to wreck a locomotive. The old man bought a fine "Grasshopper" engine at Cleveland, and had her towed into the shop, and set us boys to cut her up, which we did, with many regrets on my part. She was a good specimen, and apparently in good working condition. I remember the superior workmanship and fine proportion of the connecting rods, which were hollow and very light, made with forked ends to fit the polished brass walking-beams. The beams were hinged to the top of the vertical boiler, and the engines coupled on at about two-thirds the length from the fulcrums, while the rods were coupled to the ends. She had a hook valve motion, but I can't describe it now. The boiler contained about 400 small tubes, and had a fan to create draught. The engines were connected to a countershaft, and thence to the driving axle by gears. The drivers were small—probably three feet. She was built by Winans, of Baltimore, and was probably of the same design in detail as the one illustrated in your paper a few months since.

I never felt quite right about that bit of vandalism, but congratulate myself that I was not the instigator of it. I got nothing to speak of for the job, being only an executioner *ad interim*—a poor excuse is better than none.

The Stephenson locomotive erected at Darlington, England, as a monument, suggests the idea of disposing of all our old veterans in a similar way, and I regret now that this one was not spared for such a purpose.

Brazil, Ind. C. W. CRAWFORD.

Injectors.

Editor The Locomotive Engineer:

In a recent issue of your paper you make some reference to "Alexander's Ready Reference." Will you please give me your opinion of a statement taken from the above book? On page 12, of his "Reasons Why," explaining the principle of the injector, he says: "Steam confined in a boiler may be considered a body at rest; the instant it is released from the boiler it becomes a body in motion, and thus, in passing through the pipes and injector, it sends water into the boiler at a force much greater than that at which it left the same boiler only an instant before."

Where does the *extra* pressure come from? S. A. A. explains by an illustration. True, if we take a pound weight and let it fall one foot we obtain one foot-pound; if two feet, two foot-pounds, and so on, which is, as I understand it, a force generated by the *falling* of the weight (by attraction of gravity); but, are the same conditions present in a boiler? I have always believed that the "self-feeding" feature of steam boilers, by means of injectors, inspirators, etc., was owing to the *reduction* in area at point of admission of feed water to the boiler, from that at which the boiler is tapped for steam. JOHN BRUCE.

Pittsburgh, Pa.

[The pressure in the boiler may be considered static force—a body at rest—while the feed water is dynamic force, or a body in motion. The injector works because of the difference in velocity between the flow of steam and water at the same pressure. Steam flows about twenty times as fast as water, and the steam flowing through an injector gives up part of its heat and velocity in order to pick up water and gain weight. The extra velocity imparted to the water causes it to lift the check and enter the boiler. The more steam you can use on a given amount of water, the greater pressure you can force the feed against. Testing injectors are made that take steam from a boiler at 100 pounds pressure, and force it into another against 300 pounds pressure. They are so constructed as to throw a small quantity of water at high velocity. The steam nozzle of an injector is always larger than the combining or delivery tube, and this may be considered as the large steam cylinder of a pump with a small water cylinder, except that in the jet instrument the movement of the piston is continuous, and that there must always be enough water to condense the steam used.]

Criticism of the Lehigh Valley Engine.

Editor The Locomotive Engineer:

Speaking of the engine on first page last month you say that "it is cooler, cleaner, and easier riding in a cab placed near the center of the boiler," and that "it is safer, and the view of track better for the engineer." Now, if you will look again, I think you will see a mistake here. In case of a side rod breaking, the cab is in just the place for it to come up through the running board and paralyze the engineer or fireman. Again, in case of a head-end collision, it is easier to get off if the cab is on the back end of the boiler. It is just as cool, and easier to clean the jacket if it is all in front of the cab, and I never heard an engineer complain about seeing ahead out of a cab placed on the end of the running boards, and it certainly looks more natural than stuck up so far in front, and if placed on the back end it does not separate the engineer and fireman, which should not be done. It is a fine engine in many respects, and will, no doubt, do good service and make a good showing. The short front end is very neat. If the check of the feed pipe was placed up within 6" of the front flue sheet it would improve her looks and steaming qualities by giving her a better water circulation. Another improvement would be to take that spring balance off, and set the whistle in the top of the dome.

Now, Mr. Editor, you may think that I have lots of "gall" writing this way, but it is my nature. Some time I will tell the boys about my first lesson on pumping and running an engine so as to make her steam, do her work, and not kill the fireman.

In conclusion I will say that I wish THE LOCOMOTIVE ENGINEER was a weekly instead of a monthly paper. "COWBOY."

Ft. Hancock, Tex.

[An engine rides easiest at the center of the boiler and hardest at the ends where the most oscillation takes place. More men are killed between the engine and tank in head-end collisions than in any other way, and this cab is easy to get out of without running the chance of getting pinched. It is cleaner and cooler, because there is no smoking fire door in the cab, and dust from the ash pan goes up behind it. A person used to a cab on rear of boiler would be surprised at the difference in view by being placed ahead and higher up; you can see across curves and on tracks to the left. Side rods once broken will get to the cab anyway if long enough; and this is a hard-coal burner, where the fireman spends most of his time in the cab ahead.]

The Cause of Slipping Again

Editor The Locomotive Engineer:

I have been much interested in the slip of drivers phenomenon. It has been claimed to have occurred on two prominent Southern roads recently, both of which twisted the axles and one broke both axles close to hub of driving wheels. Slipping, I think, is of two kinds, in which doubtless many get confused. As I understand it, when shut off, running down hill, drivers turn faster than is due to the engine's speed, which can be from two causes, over-counterbalancing or improper quartering. Badly put up side rods would produce the same results as bad quartering, as it would cause the engine to roll over a given point with a jerk, and with the aid of the counterbalance would slip. I remember two instances which have been remedied, one by quartering and the other by boring out side-rod brasses much larger than the pin.

In the other kind of slipping, or skidding, the engine is propelled by a heavy train down hill faster than wheels turn. I am sure an explanation is hardly necessary to the old and experienced engineer. It is, however, not understood by all that the plain slide valve will raise clear off the seat one-half to three-quarters of an inch when shut off, running thirty-five or forty miles an hour, if valve yoke will permit it, and whenever an engine falls back against the train, or if brakes were applied in front, it is because there is not enough space between valve yoke and valve to let the valve up and permit air to follow piston freely and without retarding effect. If any one doubts the above theory I would suggest that they would put a liner between yoke and valve, taking up the entire space, get her under good headway down hill and shut off, and I will venture that she will not roll down the side of a mountain. This, I think, was the trouble with Mr. Bosley's engine when he had to pull the lever back to center to relieve her. Another point which is very detrimental to an engine, and which causes nosing when shut off, is to have an eighth clearance on one yoke and one-half inch on the other, as is frequently the case where the seat or valve is faced off more on one side than the other. The objections we so often hear of to the balance slide valve are that they are given too little space between valve seat and balance plate, which gives piston no relief during the expansion period of valve travel, though such engine may have a relief valve. This engine will also fall back on train on a down grade, as if brakes were applied on the engine. D. O. SMITH.

Mobile, Ala.

[Side rods that produce a jerk at any one point of the stroke would increase friction and tend to retard rather than accelerate its speed, and boring their brasses out so as to free the rod would give the engine a better chance to slip ahead than it had before. Our correspondent makes a broad statement about the action of slide valves; if the reverse lever is put at or near full stroke when shut off, the valve opens the port before the piston starts back, and gives a full opening for air to follow until at least two-thirds of the stroke, while the other port is kept in communication with the exhaust for about the same length of time. It is the compression of air ahead of the piston after the port is closed that lifts the valve, but this in an engine running with the valves traveling full stroke is very slight indeed, the further back the lever is left the more the compression of air will occur, on account of the earlier closing of the port, and the valve will then be lifted. You can hear the valve raise and fall on the seat when the lever is left hooked up after shutting off, but it is stopped at once by dropping the lever into the corner. The cases of slipping distinctly state that the engines slip *ahead* while running down hill pushed by the train; no skidding surprises us, there are many things to help it, but what makes 'em slip ahead, overcoming friction, air resistance to the piston, etc.? That is the question.]

That Hoodoo Model.

Editor The Locomotive Engineer:

Say ! Talk about Barnum's circus , but for clean-cut fun of the vintage of '77 you should have been up to our division meeting last Sunday, when we unboxed one of those valve motion models whose stepmother you are supposed to be.

But let me commence at the beginning. Last winter, when the picture of the motion floated in with the L. E. I spotted it as just the sort of a thing *we* needed and *I* wanted, so the next Sunday I got up and proposed that the division set aside the necessary cash to get one. Two old plugs stood up and contested the right for the floor to ask what good the darn thing could do. I told 'em to help us understand the link motion.

Windy Brown said any man that knowed enough to run an engine knowed enough to set valves, or anything else I said he didn't.

Black Pete Yonder said we couldn't afford it (division has over a thousand cold dollars in the treasury). Then I proposed we go in halves with the firemen on it.

The chorus kicked, and High Water Wilks got up and said, in a sort of sneering way, that he would vote to buy a model boiler, and ask the firemen to practice on *that*, before they went into valve motion and other things "belonging to us" (the engineers, I suppose).

Then I asked High Water what *he* knew about firing; could he tell what was a fair amount of water evaporated for a pound of coal burned, and after he wouldn't answer I offered to bet $10 to 10 cents that he couldn't tell what steam was—and I'd leave it to the men present. But they were, as a body, opposed to any "school" in the division; didn't come there for that—but still they wouldn't tell what they did come for. The great objection was expense for a "fool thing like that."

I got my back up a little and I trapped 'em, first I asked them if there was anything new about the link motion—wasn't it just like a locomotive as near as could be ?

Yes, it was.

Wasn't it handy to get at, and so fixed as to see all the parts of the whole engine ?

Yes, but what good was it ?

Then I offered this communication, and the F. A E. read it.

Officers and Members of —— Div. No. —— B. of L. E.: If your division will purchase a Pedrick & Ayer valve motion model and open the packing case and set it up in open division, and there are any two members present who can set the valve to cut off *exactly* square for all points of cut-off, in both forward and back motion, I will pay for the model myself then and there. JOHN ALEXANDER.

They all sat as still as a Quaker meeting for a full minute, then Puffy Williams, an old machinist runner, got up and went over and whispered to Swifty Smith, shaking his head and jerking his thumb; but I got up, and, pretending mad, went for 'em hot. Accused them of knowing something once, but being so no-good as to forget it, and told 'em the firemen had ordered one of the models and was going to set it up at their annual ball and challenge the Engineers' Brotherhood to put up their best man to explain link motion against a fireman for a prize, and asked 'em who they'd send, or if they dared to send anybody?

Then Puffy Williams arose and sucked in about fourteen cubic yards of atmosphere and said :

Worthy Chief and brothers, I think Brother Alexander has misabused the scientific ability and mechanical sagacity of the other brothers present, and he ought to be suspended for ten months for unbecoming conduct, but just once in a while a blowhard gets took down ; now I propose that this division accept that paper of his and place it on record, and the F. A E. be requested to correspond with the makers about the model, with a view to getting one.

I wanted it ordered at once no use writing about it , we knew what it was like and what it cost.

But Puffy argued for the slower process, and ended by saying, lofty like, and with a patronizing look at Swifty, "and I think there is some engineers present in this here room that kin show our smart brother that they know as much about valve motion as the firemen—or him either."

As I was putting on my rubber coat out in the anteroom I overheard Swifty tell some of the fellows : "He's gettin' too dam smart, and we'll jest make him pay that $70 or expel him—that's all—he's a sucker anyway ; I saw him oiling around his motion work, and even the spring hangers, with a *squirt can* ; it's jest such suckers as him that's getting things down so fine a decent man can't run an engine any more." But I only laughed and went home.

Ever since then I noticed Puffy and Swifty both talking a good deal with old Silas Parsons, the man who sets valves, and watching him at work, but I kept away and said nothing.

Last Thursday the model came and I got a notice to be on hand at the division meeting—I was there.

The regular business was hurried, and we finally got to "unfinished business," and the chief ordered the opening of the crate and a recess of five minutes ; during this time all hands helped at the unboxing and setting up but me. I overheard Puffy whisper to Swifty to "look out that he don't get at that model and 'hoodoo' it." So I didn't even look.

Well, they finally got it all together, every man but myself gave it a few turns and called it a "cob-chopper," "feed cutter" or "sausage stuffer," and at last left it in front of the presiding officer, with the working side to the audience. With a show of making it legal and binding, the chief asked me if I was ready for the trial.

I told him yes, and went up and put $70 in the hands of the F. A. E.

Then the F. A E. read the resolution I had offered again, and suggested the appointment of judges.

I offered to leave it to the whole lodge, but they finally made the three first officers of the division judges.

The chief asked who would try and earn seventy dollars for the treasury by setting the valves of the model, and put on a postscript to his speech by saying that he "reckoned there wasn't an engineer there but what could do it."

It was worth two hundred dollars to the company, just the little posting up on valve motion most of 'em did while waiting for this model.

When he sat down, old Puffy and Swift got up with great importance and offered to try, and in each of their eyes I could see in letters of fire the old motto, "There is no such word as f-a-i-e."

Both took off their coats, and Swifty went out in the hall and brought in the road's standard tram, a package done up in a newspaper, and old Silas' dividers and scale. I suppose they wanted tools used to the work.

Puffy turned the wheel and Swift went down into the package and fished up a piece of thin Russia iron that Silas used to put down into the ports to "feel" the valve opening when putting tram marks on the stem.

But the port was not there in the model just as it was in the locomotive, and they could not get the tin between the valve and the port, so they whispered a minute, and finally the chief suggested that they merely look at the sharp lines on the edge of valve and port and set by them. They did so and made some prick punches on the valve stem.

Then Swifty smeared the front of the tire all over with chalk from the package—same chalk Silas used , it couldn't go wrong.

Then they started in to find the dead center. Swift held the wheel and Puffy did the dizzy work now, and they did pretty well, excepting that they were not particular which way they turned while approaching center marks, but that didn't matter much ; the model was neatly fitted and had very little slack, but they only took one end

Well, just here Swift discovered the instruction book tacked on the back, and proceeded to consult it, but the judges said it wa'n't fair and made him stop, although I offered to let him use it.

This got Swifty nervous and red in the face, and all he did after that was to offer suggestions and help muddle Puff, the latter stuck to his work, but it was plain he was getting mad ; then, to make matters worse, the boys commenced to offer suggestions.

The valves did not travel evenly each side of the seat, and Puff went for the eccentrics, and that changed the lead ; then he moved the blades, and that changed the travel, but didn't help the lead, and the boys guyed harder. Puff finally turned and announced with a red face that they could either shut up or set the pesky thing themselves ; they kept still.

He moved the reverse lever and tried again, but it didn't come out right , he got her pretty square in the corner, but she was a trifle "out" when hooked up, and finally he broke off the handle and half kicked the model over declaring it was "hoodooed."

The room was pretty full of men by this time, and they laughed heartily, but quit when I got up and asked for any one else to try it, as the offer was good to all.

One bright young fellow, who hadn't belonged but a couple of weeks, went up to the model and said he'd try, and asked to hear the resolution read, when he heard it he sat down and smiled.

"Won't nobody accept the offer and save the lodge $70 ?" asked the chief.

The young fellow suggested that the chief try it.

"I am a judge in this case, and it wouldn't be fair for me to do it," said he.

I was kind and offered him the chance, but he wouldn't have it, and some of the fellows commenced to itch for adjournment.

The chief called for volunteers, but none came, and at last he declared I had won.

Then I claimed the chance for a lecture, and I told them fellows they ought to be ashamed to not try and set the valves , they wanted me to do it myself, being I was so smart. You ought to have seen their eyes stick out when I owned up that I couldn't, and when I declared it was impossible to get them *exactly* square for all points forward and back they were interested enough to want to know why—that's progress.

In the discussion that followed every man present but Swift and Puffy virtually acknowledged that they didn't know much about link motion, and most of 'em said they wanted to learn.

Puff and Swifty declared they knowed how to set valves on a real engine, but that that model was "hoodooed," and no good.

Next Sunday we commence a regular discussion on valve motion, and when we have worn the interest out of that subject I hope they will see the necessity of tackling something else.

I suggest to the builders that they put a dingus of some kind on the model to hold the wheel still at any one place, so that one man can set valves; a clamp and thumb-screw on the shaft would be good.

Come up next Sunday and hear an illustrated lecture on link motion that will make your hair stand—I have agreed to tell all I know, and some things I only think, and let the boys ask questions —just for a starter.

Boston, Mass. JOHN ALEXANDER.

They Can't be Run for Fun.

With a full passenger list it costs about $25,000 a single trip to run such boats as the Normannia, City of New York, or Teutonic. It costs $1,000 a day for coal, $500 a single trip barely pays for the oil The salary list for a trip of eight days is a little over $2,000. The food and drink for crew and passengers of a recent trip of the Normannia cost $16,000. During the busy season these boats receive about $50,000 a trip in fares and freight receipts.

A remarkable invention has been made in Australia. Glass tubes project before the train, and if they are broken by an obstacle an electric movement is applied to the brakes, bringing the train immediately to a standstill.—*Ex.*

What a great help that will be—to set the brakes when two engines meet on the main line. Just like hanging a corpse to be sure it is dead.

The elevated roads of New York city are limited to 40,000 pounds in the weight of locomotives, and are having some thirty new engines built at Baldwin's with wrought iron drivers to keep down the weight. Their engines carry a heavy cast iron stack that it would seem easy to trade for a sheet metal one weighing about one-third as much.

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CONTENTS.

The Chances for Economy in Running Locomotives.

Economy in operating locomotives is what every progressive motive power officer is seeking, some in one way, some in another.

The greatest chance for the exercise of economy is in the use of fuel, and the greatest number of tons of load transported the greatest number of miles to a ton of coal consumed has come to be the general gauge applied to test a road or an officer's accomplishment in locomotive economy.

Broadly speaking, this is a good test, but "circumstances alter cases," and there are quite a number of railroads in this country on which it does not pay to save coal by the use of "improvements," and if it could be proven that compound locomotives would decrease the fuel account fifteen per cent. it would not pay to adopt them. Where coal is worth less than one dollar a ton it don't pay to complicate anything on the locomotive to save it.

Where coal costs from five to fifteen dollars per ton it does pay to complicate almost anything to save it.

The Central Pacific road experimented many years with valve motion, and at last adopted one designed by A. J. Stevens, then Superintendent of M. P. This device is complicated, and costs more on the start and requires more running repairs than a common link motion; yet the road is running over sixty locomotives with this gear and find it pays slightly, all things considered—coal is worth more than ten dollars per ton there.

Everything that simplifies a locomotive with a gain, or even without a loss, should be adopted.

The best results we have heard claimed for the fuel economy of any compound locomotives in existence is twenty-two per cent., and perhaps ten would be a fair average, when the conditions are favorable to the compound. Now we must deduct from this gain the interest on excess in first cost and amount of running repairs over those of plain engines—extra parts mean extra cost of maintenance.

And so it is with every device invented to effect economy—its value depends upon its cost and maintenance over the old plans—if it is simpler and requires less care the amount less should be credited to it, if it costs more the amount should be deducted from the saving.

There is just one means of economical locomotive operating that is not covered by this rule; just one improvement from which there is no discount, no extra pieces, no extra maintenance, just one chance for clear gain, and that is in the improvement of the men on the locomotives—improvement by themselves.

The fuel economy that has been accomplished from this source is seldom less than ten per cent., and has often exceeded fifty per cent.

Every time there is a new device gotten up for "improving" locomotives the inventor or his agents go out with it and a picked man runs the engine. No possible chance to save is overlooked, and the result is a big showing—for which the device gets the credit.

A few years ago a feed-water heater was tried upon the Manhattan elevated road, a place where great care is taken to know just what the engines are doing, the returns from the trial were a surprise and the device got considerable credit; but the foreman of the shop was not satisfied, so he took the same engine, shut off her coal-saving heater and put a third man in the cab, with instructions to watch every opportunity to save *steam*, to, under no circumstances, let the pop lift, avoid unnecessary firing near terminals, etc., and the result was that the engine beat her "heater" record by eight per cent.—nothing but care and pains. Where coal is the cheapest thing to be had the care must be exercised in another direction.

There is scarcely a road in the country where there is not a very great difference in men about tire wear, and a man who is a "tire-grinder" is generally a grinder on everything else. Attention to the proper water line saves valves, seats, pistons, and cylinders. Intelligent use of what brains there are in your heads saves an awful bill in car repairs every year.

The more you think of the matter the greater the chance for economy in operating seems. We don't ask men on hurried runs to oil with a squirt-can or anything like that, sacrifice oil, coal or tire to make time, but use your brains; it will become a pleasure and make better enginemen of you.

On the P. R. R. the engineer and firemen each receive sixty cents per ton for all coal saved over a certain fixed rate—some of the boys haul in from $14 to $24 a month regular, others on the same runs have never won a premium. Which of these is the true engineer and fireman? We hope to see such a rule on all roads some day, where every man who *tries* will get paid for it, as he ought, and where the sluggard will not be considered an engineer because he is the older man or because he draws first-class pay, or does or does not belong to anything.

Neither the railroads nor the men can overlook the advantages and the chances for clear gain in improving the methods of the men upon our locomotives, instead of the locomotives themselves.

To the roads we would say, make it an object to the men to improve themselves—no library or bath-house, or vacation, or prize for the best, but a fair percentage of the gain made by each crew—it will pay the road well, without the payment of a royalty or the shopping of engines, for the improvement.

To the men we would say, *try;* don't be ashamed to show an interest in your work; it will tell in the long run, and be to your credit, and you will be in practice to reap reward when the sharing of profits of the results of economical working become universal, or strike your road.

We are not arguing against the adoption of compound locomotives or anything else; they will come and go on the natural rule of the "survival of the fittest," but the chance of improvement in locomotive engine running and firing will always be present. There may seem but little encouragement to try, but it will pay and will be soon noted, and credit given.

Engineers and firemen of America, you can show a better economy than any change in locomotives now contemplated if you will try. Try!

Some Lessons of the Strike.

The N. Y. Central road has paid its penalty for submitting to a strike—paid it in cash, charged it to profit and loss, and—forgot about it.

Some two thousand workingmen have just commenced to pay their penalties for going into a strike, and they are likely to suffer a long time to come—it is like purgatory; no one seems to know how long it will last.

Last month we blamed Mr. Webb for refusing to treat with Mr. Holland because he was not an employe of the road, and we still maintain that no road has a right to refuse to listen to the accredited representative of the men—to do so is to deny them the right to employ an attorney—something the roads always do.

Since last month, however, we have personally investigated several phases of the late trouble, and are now satisfied that Mr. Holland was treated very courteously at Mr. Webb's office; he did not present any evidence that he came from the men, and none was asked; he was not ordered out of the office, Mr. Webb simply refused to grant the demands of the strikers.

Mr. Hays got into Mr. Webb's office by presenting the card of a priest, and talked for some time before he announced that he had a letter of introduction from the priest—he could have got in by sending his own name.

A good many men had been discharged before the strike, no new ones were employed in their places, the road was simply reducing forces, and did what every individual among the strikers would have done—let out the men less useful, and those causing them the most annoyance.

Had the employes of the N. Y. Central come before the public in a contest for wages they would have had sympathy and support—the road does not pay the best wages.

One lesson, that it is to be hoped has been learned for all time by most of the men, is that there are bound to be fire-brands and reckless leaders in any organization, and where one little division or assembly has the power to call on a strike, trouble will surely come—it is too easy to strike in the K. of L.

Another lesson can be learned by reading the plain, sensible and manly arguments Mr. Powderly advanced in his letters to prevent the strike, and then comparing them with his actions after the strike took place, declaring that they would win if the men held out, and that it was a fight for the life of the organization, etc. This prevented many good men from getting their places back, and the life of the order was not at stake—the jobs of a few leaders like Lee were at stake.

Another lesson can be read, in letters about four feet high, in the plan proposed by Mr. Powderly for winning a big strike on this road when it was crowded with business during the World's Fair.

The officers of the federated orders came and investigated the trouble, and held a meeting to decide whether or no they would join the Knights A good many men thought they had no right to convene. We give the officers credit as shrewd advertisers of the use of federation. The Knights were alone, the other orders united, and while they sympathized with them they showed how their cast-iron rules deferred a strike to the last resort, and the unanimous consent of the bodies interested In the federation it takes four whole orders to cause a strike—one little assembly caused one on the Central.

No strike will ever be won on any railroad in this country by any one order if the road is disposed to fight. If all the orders unite there will be no strike, if either side is disposed to be half way fair.

The N Y Central strike is over. The officers of the road have done wrong if they have refused to meet every man who came to adjust a grievance—which the men allege they have done.

In the employment of Pinkerton men, before they tested the efficiency of the civil authorities in affording them protection, they committed a grave fault, if not a crime. There is redress for all loss where the civil authorities fail to protect property. Allegheny County (Pa.) paid the P R. R hundreds of thousands of dollars for damages to property during the strike of '77

The wrecking of trains since the trouble commenced will hurt the road a little in scaring away timid passengers, but the crimes will all be laid at the door of the order, and some one will go to the penitentiary. Any man who deliberately wrecks a train, for any cause whatever, deserves to go to the gallows; be is worse than a murderer.

During the Q. strike many divisions of the B L. E. would not pay the assessments to support the men, and the Knights complain of the same treatment in this strike—this shows that the sinews of the striking functions of organized labor suffer from partial paralysis, and the lesson should be learned in advance. When workingmen will not support other workingmen on strike it is a hungry time for the strikers.

Strikes and lockouts and labor disputes will be forever dead when laboring men can choose between the jobs they prefer, and a certain livelihood working for themselves; this may possibly occur when any man can occupy unused land; this may be a cure and may not—it is worth investigating, and our advice to laboring men far and near is to study some plan of relief and stop listening to the agitator, who thinks he can change human nature by force and make railroad officers or other human beings submit the discharge of employes to a committee of the employes themselves—or any one else.

Accidents crowd upon accidents. This year has been the worst in the history of the country, and the more miles of road we build the greater the slaughter. When business is poor, or only fair, the accident returns are bad enough; but a rush of business means that the crop of accidents will increase as the square, if not as the cube. In many of these fatal accidents some employe has blundered or was incompetent, and if the victim or victims were passengers the poor devil has been prosecuted or branded as a criminal. But in nine out of ten cases the victim was a railroad man, and the case is marked up in the company's books as an "incident of a trip" In every reported accident this year the writer has investigated it to the best of his ability, as a practical locomotive engineer, and gives it as his honest conviction that eight out of every ten fatal accidents would have been averted had the best and safest equipment been in use. The reckless rivalry among the roads to do the business at any price, causes them to pinch the dollars very close to pay fixed charges and dividends, and this leaves the operating and motive power officers no choice but to seek for equipment that "will do for the present," instead of putting in the best and safest known.

It has been proven that the different orders of railroad men pay out enough every three years in death and disability claims to equip the rolling stock of North America with automatic couplers and power brakes The companies are resisting the pressure brought to bear on them in this matter, under the plea of expense. Who ought to bear the burden of murder by their crude equipment—the companies or the men?

Promotions.

James Heron, one of the strong advocates of self-improvement for railroad mechanics, has been promoted from the Horton (Kan.) shops to be foreman of the boiler shops of the C., R I & P. at Chicago. Mr. Heron has been a correspondent and friend of this paper from the outset, and last year sent in more than one hundred subscribers; but we don't claim this caused his promotion—it was his work and study to cheapen and better boiler work

H. V. Rosing, chief draftsman of the Illinois Central road, has been promoted to be master mechanic.

A. J. Sovereign, of Brainerd, Minnesota, has been appointed assistant superintendent of the Fergus Falls and Black Hills division of the Northern Pacific. Mr Sovereign has been with the N P. a long term of years as an engineer. The roads of the Northwest seem to understand that practical men do best in positions of responsibility.

Books Received.

POOR'S HAND-BOOK OF INVESTMENT SECURITIES A Supplement to Poor's Manual of Railroads

This book is intended principally for bankers, brokers, and investors in railroad securities, and is invaluable to them, and of interest and assistance to railroad officials. It contains:

A table showing the range of stock and bond values at the leading stock exchanges of the country during the 12½ years, January 1, 1878, to June 30, 1890

A statement of all dividends paid by the railroad companies of the United States during the past eight years

A list of bond coupons payable each month in the year, with the places where same are payable.

A statement of the stocks and bonds listed on the New York Stock Exchange during the past 11½ years, January 1, 1879, to June 30, 1890.

A statement showing for the leading railroad companies (a) close of fiscal year, (b) time of holding annual meeting, (c) closing and opening of books; (d) place of holding annual meeting, etc , etc.

A statement showing by cities the location of all railroad general and transfer offices

The book contains 300 pages of closely printed matter, and is furnished in cloth or paper at $1.60 and $2 50 respectively

ASKED & ANSWERED.

(61) A. F Cook, Lilly Pond, Ga., asks:

1. Will four gallons of water furnish steam enough for a cylinder 1⅝ inch? 2. What is the most miles a locomotive ever ran? 3. What is the most load a locomotive ever pulled? *A* 1. Depends entirely upon how long you want to furnish steam to the cylinder 2. We do not know 3. No one knows

(62) Bonafide, Alexandria, Va., asks

If an engine's wheels be blocked on the scales, and reverse lever placed in center, will she weigh any more with the throttle open than when it is closed? *A.*—No; we once knew of a wager on this subject, and it was found that the valves leaked so badly as to have the effect of a blower, and this caused the pop to lift, and showed a slight increase of weight—because the escaping steam was doing work against the resistance of the atmosphere The engineer thought the increase of weight was due to filling the cylinders with steam, and argued that the steam escaping at the pop would tend to make the engine weigh less, as it took water out of the boiler

(63) Rotary, Windsor, Ont., writes:

If the cylinders of a locomotive could give out a steady, even, rotary movement to the wheels, we could do more work with a lighter engine; now what stands in the way of using a rotary engine on the axle of the drivers? I am well aware that every big mechanic in the country will say "boo" at you if you just say rotary, and class rotary engine designers with those who are working up perpetual motion machines; but is there a reason why they cannot be made as good or better than the reciprocating piston engine? *A*—Rotary engines have an advantage in that their work is more nearly constant, but they have inherent faults that, with our present knowledge of steam machinery, puts them behind the ordinary steam engine; in the latter the piston stops and starts at each end of the stroke, giving time to admit a volume of steam upon it, and cutting off the supply, leaving the confined steam to do its work by expanding; in the rotary the piston speed is constant, and the steam hasn't time to get to work, as it has to start in to do its work against a piston going from it at full speed; it becomes a sort of turbine wheel, and an almost constant stream of steam must be maintained to keep it in motion. Small rotaries are often used in places too cramped for the ordinary engine, but they are coal-pile killers.

New Plan of Signals.

Electrically-operated signals are a success and fast coming into use. A young inventor in New York has designed a signal of this kind where the semaphore is located in the cab, instead of on the line—breaking the circuit drops the signal to danger. It operates just as large signals along the track do, and it would seem to prevent a man from mistaking a signal for another track or siding for his, and, of course, can always be seen, regardless of fogs

In this device a bell is rung at every move of the signal, so that a man's attention is always directed to it. The inventor informs us that he has shown it to several signal men, and while they always declare against it, can offer no reasonable objection to the plan.

Ordinary signals are of a great deal of use to trackmen in their work, which his signal would not be, and we do not see how his could be made to signal for switches turned, but they could have signals of their own as now.

The report of Secretary and Treasurer E. V. Debs, to the Firemen's Convention, held on the 8th, at San Francisco, shows a healthy condition of the order. They have over 19,000 members in good standing, 435 lodges, and a credit of $60,000 in the bank. Grand Master Sargent recommended the order to build a Brotherhood headquarters in some central city, to cost not less than $150,000.

On some engines recently built in Glasgow, Scotland, for Government railways of the Argentine Republic, the blower pipe enters the side of the arch on a level with the high nozzle, and is bent around it, the end is plugged and the top of the bent pipe drilled full of small holes, it is claimed this makes a much more efficient blower than a plain nozzle.

The great tunnel between Sarnia, Canada, and Pt. Huron, Mich., under the St. Clair River, is opened through. The headings from the opposite sides met under the river within less than one inch of variation.

The recent convention of the Conductors' Brotherhood at Toledo, O., showed a very encouraging growth and enthusiasm. Grand Chief Howard is an old Brotherhood engineer, and an organizer of no mean ability.

Carpets in car aisles gather all the dirt and filth imaginable, as also does matting. What is the matter with an aisle floored with permanent colored linoleum? It is neat, clean and warm.

One of the new "Class P" engines, with Belpaire boiler, blew off her dome in Jersey City on September 10th Her mate, the 1,323, was illustrated in these columns last December

The article on side rods, in the correspondence department, has a good deal of sense in it. The cause of side rod trouble is no doubt as our correspondent describes it.

It is no credit to railroad managers of this country that they oppose the 24 hour system of running trains On the Canadian Pacific it is a perfect success.

Simple Lessons in Drawing for the Shop.

By Orville H Reynolds.

TWELFTH PAPER.

In Fig. 81 we have a side view of a spur gear, which we have sketched in our book, with the purpose of making a copy of it on the drawing board. The data we have filed for use on the drawing consists of the number of teeth, the pitch of teeth, breadth of teeth, diameter of hole, pitch diameter, etc.

Draw center lines *A B C D*; from their intersection *G* as a center draw a circle with the compasses, set to a radius of $\frac{3}{8}$", to represent the hole.

With the radius 1.91" on compasses draw pitch circle *E F*. Lay off below this pitch circle a distance equal to four-tenths of the pitch, which will equal, in this case, two-tenths of an inch (the pitch being $\frac{1}{2}$").

Outside of the pitch circle lay off a distance equal to three-tenths of the pitch, or fifteen hundredths of an inch. With these points as laid down for radii, describe two circles, the outer one representing the top of teeth, the inner one the bottom of teeth. The whole depth of tooth will therefore equal seven-tenths of the pitch.

Lay off outside of pitch circle another point, a distance equal to one-tenth of pitch, or five hundredths of an inch, lay off another point below the pitch circle, equal to five hundredths of the pitch, or twenty five thousandths of an inch. Taking on the compasses the distance from center *G* to the points laid down for a radius, describe circles *H I* and *J K* respectively.

Divide the radius of pitch circle into six equal parts; subdivide each of these parts into four equal parts and we have twenty-four points from which to draw lines through center *G*. These radial lines will be the center lines of the teeth.

It is unusual in shop practice to delineate all the teeth in a gear wheel, a few being enough to show what is intended; in this case we will show one-half of wheel. Lay off on pitch circle *E F*, from each side of center lines of teeth, a distance equal to twenty three hundredths of the pitch, to represent the thickness of tooth, which is to be equal to forty-six hundredths of the pitch, leaving the space between teeth equal to fifty four hundredths of the pitch.

Taking on the compasses a radius equal to the pitch of teeth, set them on the circle *J K*, and describe face of teeth, reversing the compasses, the opposite face of teeth are delineated in the same manner.

The compasses are to have the same radius for the flanks of teeth, which are described by placing the point on circle *H I* with the pencil, joining the faces just drawn at the pitch line; reversing the compasses the opposite flanks are drawn, as in the case of the faces. At the roots of the teeth draw small arcs.

This method gives a first-class wearing face for all pitches of teeth, with the advantage of a close approximation to accurate results.

Lay off each side center line *L M* half the breadth of face, and project from side view with the T square, the upper and lower teeth, also the keyway and diameter of hole. Section lining the view we have, it will appear as in Fig. 82.

If it were full edge view, and not a section, the teeth would be projected from side view, and look as shown in Fig. 83.

When toothed gearing is used to transmit motion from one shaft to another, whose axes are not parallel, bevel gears are employed. The teeth of such gears are not of an equal thickness, as on a spur gear, but are tapering, being largest on outer side, this taper being due to the angle of the teeth, which is found by drawing from the intersection of center lines of shafting, as shown at *A B*, Fig. 84.

When a drawing of bevel gears is intended for shop use, the time of the draftsman is again saved by condensing the operation into a section and half plan, also making an end view of one tooth, as shown in Figs. 85 and 86, the pitch and number of teeth being written on drawing.

After the angle has been found, as in Fig. 84, reproduce it in Fig. 85 by first drawing the center line *A B*, and laying off from it the pitch diameter as at *C*. From this diameter draw lines intersecting center line at *D*, and we have pitch line *G*, from which to lay off the teeth.

The faces *E F* and *E' F'* are drawn perpendicular to pitch line *G*. The breadth of tooth face *H* is next laid off and the inner end of tooth also made perpendicular to pitch line.

The depth of tooth can now be laid off on lines *E F* and *E' F'*, the same as in the case of Fig. 81, the whole depth to equal seven-tenths of the pitch, as before.

From the points just found draw lines to the center *D*, and we find that the outer ends of teeth are deeper than inner ends, caused by the lines radiating from center *D*, as referred to before.

Next, drawing diameter of hole for shafting, and then depth and diameter of hub, also thickness of web and rim, we have a section as shown, Fig. 85.

An end view of tooth can now be shown by projecting the three elements of the tooth—the top, the bottom and the pitch line perpendicular to line *E F*, and drawing a line parallel to *E F* for a center line; the tooth being laid off in the same manner as on spur gear Fig. 81. Specifying the number of teeth and giving diameter of both inner and outer pitch circles, as at *C* and *I*, the section is completed.

The outline of a half plan, having a few teeth shown, will serve to show more clearly the taper of the teeth. To make the plan we take on the compasses one-half of outer pitch circle, measured on line *C* from center line *A B*, Fig. 85; with this distance for a radius describe half circle from center line *A B* at any convenient point below the sectional view, as in Fig. 86.

Take on the compasses one-half of inner pitch diameter on line *I*, and from same center as before describe another semi-circle.

Tops and bottoms of teeth are also to be taken on the compasses from Fig. 85 and transferred to Fig. 86, in same manner as was done with pitch lines.

Dividers are then set to the pitch of teeth, and the whole or part of pitch circle spaced, as time or inclination may suggest; a few teeth shown will answer all purposes. Spacing done will represent the center lines of teeth, and these lines, drawn to the center from which pitch circles were described, show the difference between thickness of teeth at outer and inner ends.

The data furnished is usually sufficient for shop use in making the gears shown.

Should the student feel that more light is necessary to a better understanding of the theory of tooth curves, he is referred to what is probably the best and most comprehensive essay on the subject in any language, viz. "Odontics, or the Theory and Practice of the Teeth of Gears," by George B. Grant.

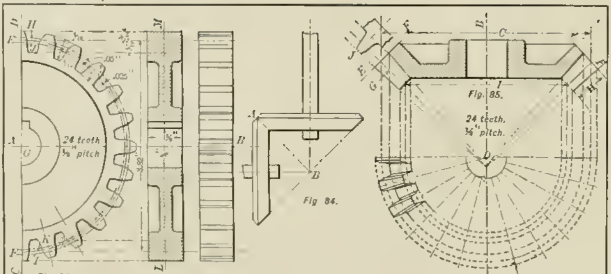

Fig. 81. Fig. 82. Fig. 83. Fig. 84. Fig. 85. Fig. 86.

SIMPLE LESSONS IN DRAWING.

The Erie road is talking of building a train of cars for suburban work, that will be without end platforms or steps; they will have a double door on each side of the car in the center, and the steps will be inside the door and inside the car; the bottom of the door will be some eighteen inches below the car floor. This plan will be cleaner, prevent draughts, prevent crowding on the platform and danger of falling off, and also prevent people from getting off on the wrong side. The car has two more seats than the ordinary coach

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About three letters a month are received from young men asking the difference between a direct motion and an indirect motion locomotive. We have answered the question several times, but repeat. A direct motion valve gear is one in which there is no rocker employed, in which the eccentric moves the valve *ahead* when its wide side is ahead of the axle, and an indirect gear is one in which the valve is pulled *back* when the wide side of eccentric is ahead of the axle—the motion of the valve is just opposite that of the eccentric.

There are a few men in this country who do not worry about the exact hour that the pay car will strike town. John D. Rockefeller's yearly income is $6,831,000, or $18,715 per day. William W. Astor rakes in $8,612,500 per year, or $23,593 at sundown of each day. Cornelius Vanderbilt gets $5,566,000 yearly, or $15,249 at quitting time each day. While Jay Gould gets a salary of but $2,718,000 a year, or only $7,446 when the whistle blows. Moral: Insure in the — get rich.

There are several men under arrest in Troy, N. Y., for wrecking trains on the N. Y. Central. By the way these ex-employes and strikers have been shut up in the company's offices, and kept in the company of detectives, and from the company of their friends and counsel, it looks as if an attempt was being made to force a confession from men not guilty. We sincerely hope the guilty wreckers will be caught and sent to the penitentiary for life.

It looks now as if the D. L., & W. ferryboat "Bergen" with triple expansion engines and a screw at each end, would become the pattern for most boats of that class built in this country. The P. R. R. are building one on this plan, and several other roads contemplate a like action. The "Bergen" is the finest ferryboat afloat in American waters.

The Illinois Central recently invited its employes to invest in the stock of the company, and offered to let them pay for shares in installments of $5 or over—the company paying interest on the amounts paid until it equaled the market price of shares. It is reported that a large amount of stock has been taken by the men—they might do worse.

Don't think we have forgotten you when you see no reply in the next issue to requests to "Give us something on spring hangers," or "Please show up an elevated engine." There are 14,000 subscribers now, and all such requests are filed and given consideration in their turn.

The Webb compound locomotive costs about twice what a simple engine of the same power does.

A Crank-pin Test Gauge.

Mr. Allan McDuff, general foreman of the Burlington, Cedar Rapids & Northern Railway shops at Cedar Rapids, Iowa, describes and illustrates a very useful device of his invention, in the September number of the *National Car and Locomotive Builder*, as follows:

I find by practical experience that crank pins in locomotive driving wheels frequently get twisted in the pin hub from severe strains of service, and also that the pin hub itself sometimes becomes twisted from the same cause. Shrinking very heavy tires very tight on driving wheels sometimes distorts the crank-pin hub. Defects of this character are nearly always mistaken for a bent crank-pin, the result being that the pin is driven out, and a new crank pin put in without producing any improvement. Sometimes the old pin is put in the lathe and found true; then the machinist who judged the pin bent is blamed for careless measuring. The man is not generally to blame. The mistake made resulted from want of proper measuring tools. My experience is that the expense and delays resulting from misunderstandings about the real condition of crank-pins can be avoided by the use of this simple form of crank-pin testing apparatus.

The tendency of locomotives is to wear the crank-pins eccentric with the original center of the pin. This causes a very dangerous defect, yet it is very difficult to identify by the ordinary methods of testing crank-pins. I have found crank-pins from $\frac{1}{16}$ to $\frac{1}{8}$ inch eccentric from the true center of the pin, yet they were declared by skillful machinists to be all right. The journal was smooth and truly cylindrical, as found by calipering. In ordinary practice, pins in this condition are sent out with connections nicely fitted up, and those in charge cannot understand why the shearing of rod bolts follows, and keys enough are lost to pay for new crank-pins in six months. If an engine in this condition does not break a crank-pin or a side rod, it is more by good luck than good management.

The crank pin gauge hereby illustrated was designed to detect defects of crank-pins, and it performs the duty very successfully. The principle of the device is the making the crank-pin carry and control two marking points, which describe a circle on the crank pin hub, and on the end of the crank-pin, these circles supplying the means of showing whether or not the crank-pin is parallel with the axle, and how it stands in relation to its original center. Referring to the engraving, Fig. 1 shows a side elevation of the device as it appears when set on a crank-pin, and Fig. 2 is a transverse section of the gauge. The foundation of the device is a right-angle iron plate *A*, which presses on the crank-pin, and carries the marking connections. The marking rod *B* is held parallel with the crank-pin by suitable attachments. The tension rod *D* pushes the angle plate close to the hub of the crank pin, and *E* is a flexible strap which encircles the crank pin and holds the angle plate secure in its place. This gauge can be applied in a few minutes, and one revolution round the crank-pin will produce marks which demonstrate with geometrical accuracy the condition of the pin. If the circle described on the crank-pin hub is not concentric with the pin, the pin is not at right angles with the wheel. If the pin is worn eccentric from its original center, the degree of distortion will be shown by comparing a circle drawn on the end of the pin, by the testing gauge, with a circle drawn with dividers with the original center as a center.

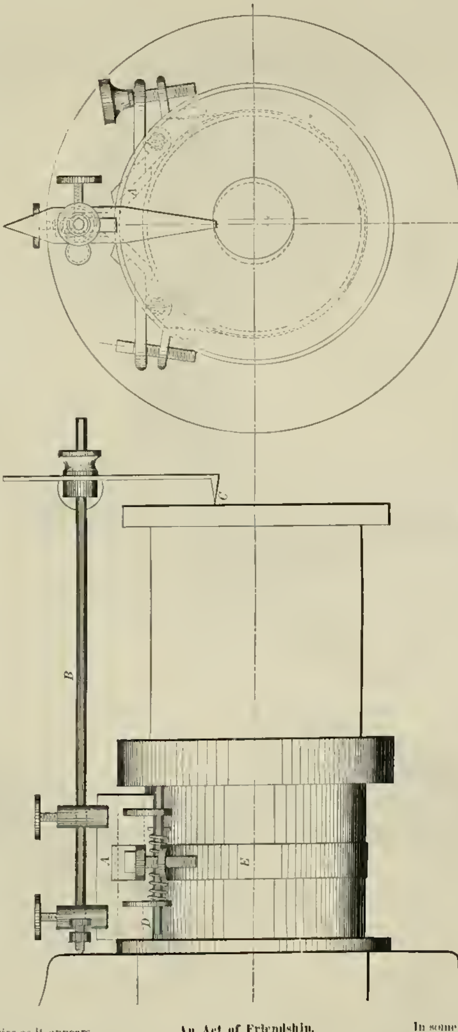

Fig. 2.

Fig. 1.

McDuff's Crank pin Gauge.

An Act of Friendship.

John Alexander's story of the frontier "reminds" the writer, who is a well-known railroad man, of Denver, Col., of a story, for the truth of which he vouches, and writes:

Way back in the days of sixty-nine, the Kansas Pacific Railroad, in its race for the Rocky Mountain country, reached the then frontier stage station of Hugo. Here a short stop was made, during which sprung up a typical western town.

Money was plenty, gambling and dance houses on every corner. Several men had died with their boots on, of which little notice was taken. But one evening Big Ben, who had quit tiring to deal faro, was detected in a crooked game. This was a very serious matter then, as now, if found out. The law and order men who had been euchred, resolved that the welfare of the town demanded that an example should be made of the guilty party. So in the early part of the night a number of the leading citizens accompanied Ben down to the railroad bridge, where they *hung him*. A placard was attached to the body, warning all parties from interfering, on pain of similar treatment.

Among Ben's friends were two engineers, Mart Baird and Jack Vaulin, they had known him back in the States, and they agreed to show their friendship by according him a decent funeral.

A blanket in those days was considered a pretty good coffin, but the friends determined that he should have something better, and as near what he would have at home as they could give him.

If detected in removing the body it would be death to them. But they had been used to facing dangers, and towards midnight, when everything was still, *O no!* everything was in full blast, Mart and Jack started on their errand of friendship.

Between them they carried Mart's trunk—the nearest approach to a coffin in town. They soon reached the bridge, and cut the body down, but now an unthought of obstacle arose. The body would not go in the trunk. Mart, ever full of resources to help a friend, said, "Jack, you skip up to the 23 and git my hand saw." He was soon back, and in a short time they had Ben's legs *sawed off*, the body packed in the trunk, and he was then decently buried in his unmarked grave.

Mart quit the road, married a Mexican woman, secured a competency, and was shortly after killed by a Greaser, who envied him his success.

A few weeks ago, while at Los Animas, in a clump of bushes beside the Purgatory River (pronounced picketwier), I was shown the grave of poor Mart, waiting for the Caller. Jack, when last heard of, was running on an Eastern road, should this meet his eye, he will know that that night's work is still spoken of as the act of brave engineers.

Young men are constantly writing us asking that we answer through the paper where they can get a position as fireman. We cannot publish such letters; they are useless. Apply to the motive power officials of some railroad.

In some ten-wheeled passenger engines weighing 130,000 pounds, recently built by the Brooks Works for the Big 4 road, driving journals 8x10 inches carry 17,000 pounds each. Pretty heavy load for a fast engine.

During the past year the Switchmen's Mutual Aid Association received the sum of \$97,527.34 in dues and charter fees, and paid out \$92,331.86. Of this amount \$76,000 was paid on death and disability claims. \$76,000 will relieve lots of suffering—and there is lots to relieve.

An Efficient Car Replacer.

We don't know why the humped-back pieces of iron with a claw at one end and a plow clevis at the other were called frogs—probably because they looked as little like a frog as possible.

Just why they were carried on the back of tenders and in way-cars to put under derailed cars and engines we never could fully account for, as in an extended acquaintance with them we never knew one to stand up to business without injury to itself, nor did we ever see one that did not overdo its work when it did any—one end had to be above the rail, and when the tread of the wheel mounted that end it carried the flange above the rail, and the cramped and twisted truck would crowd it over the other side.

If from any cause the derailed car came back upon the track, and was pulled too far, the frog would derail other cars. The ideal frog or car replacer would seem to be one that will of itself furnish all the guides, frogs and blocking necessary to replace derailed cars—one that is capable of straightening a "slewed" truck, one that can be placed in position for a pull in either direction without danger of slipping, one that raises the flange of the wheel outside the rail higher than the rail, and only raises the inside wheel high enough to let the tread over the rail, and one that can be left in position without danger of derailing any rolling stock that passes over it.

These requirements seem to have been met in the Norwood replacer, shown herewith. This device consists of two cast-steel blocks or frogs, a wooden cross-bar, and a clamp and key for securing the outside block to the rail.

Fig. 1 is an inside view of the blocks, showing

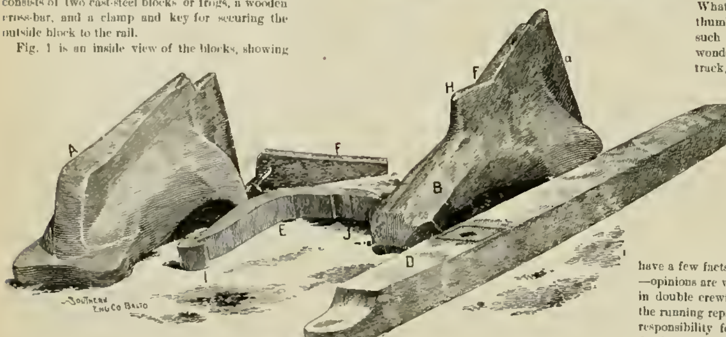

Fig. 1.

the brace for clamping and keying the pieces, and the key. Fig. 2 is an outside view of the blocks. Fig 3 shows the replacer in position, the wooden bar *D* holding the inside piece against the rail, and the clamp *B* and key *C* holding the outside piece up to its work. Any railroad man worthy the name can see how the wheels are guided by these blocks back to the rail. The dotted line shows an extension of the inside piece, by a short rail, to guide trucks that are a good way off, or badly slewed. Any railroader that has tried to slew trucks with a cramp stick, or by pulling against blocks between the rail and inside wheel, will appreciate this device.

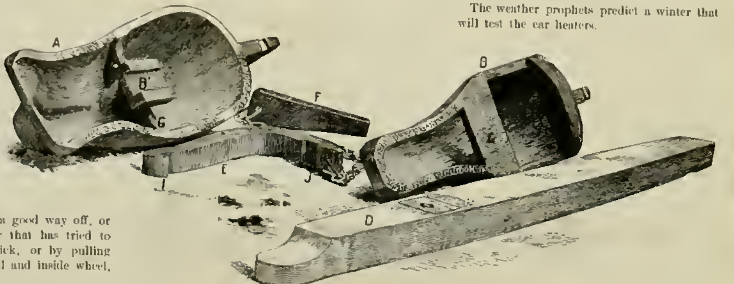

Fig. 2.

A very severe trial of this device has recently been made at Cincinnati, in which a consolidation locomotive was completely derailed and got on without outside assistance, in twelve minutes.

The five pieces comprising this rig weigh only 170 pounds, and can, if necessary, be carried by one man; there are no set-screws or small parts that can be deranged by use, they occupy no more space than frogs, and are of some use when you get off the track—which is more than can be said of frogs.

The Norwood Car Replacer Co., of Baltimore, Md., are putting this device on the market, and can furnish testimonials of prominent railroad men as to their efficiency.

A Hustler.

On July 30th the fastest long run on this continent was made by the limited train, No. 19, of the Michigan Central road. The run was over the Canadian division from Suspension Bridge, N. Y., to Windsor, Ont. The distance is 226.9 miles, and the heavy train covered the distance in the remarkable time of 224 minutes. This piece of track is the best racing ground in America, being level, straight, and kept up in extra good condition. Four miles of the run were made at the rate of 66.9 miles per hour.

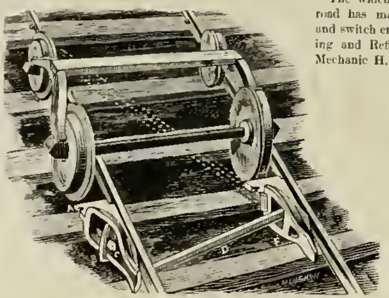

Fig. 3.

The Paris, Lyons & Mediterranean Railway has hit upon a new source of revenue. In future people who accompany their friends to any of the stations on that line to see them off will only be admitted on the platform on payment of a fee of one penny, in return for which they will receive a special ticket of authorization. The ticket is only available for one hour, at the end of which time another must, if necessary, be obtained. As this company is by far the largest railway undertaking in France, a nice little addition to its revenue is anticipated as a result of this new departure.—*Railway Engineer* (Eng.)

Almost every road in the country is buying cars, in orders of from 50 to 2,000. The number of freight cars in the country is something enormous, according to Poor's Manual, 1,060,164, and increasing at the rate of 60,000 per year. Some great improvement in loading and unloading cars, and in keeping them in service more, is badly needed. It is estimated by the competent car accountants on one of our big lines that the freight cars owned by that company are in motion less than one-fourth of the time.

The widening of the gauge of the D. & R. G. road has made it necessary to widen the yards and switch engines belonging to the Pueblo Smelting and Refining Co., at Pueblo, Col. Master Mechanic H. R. Jones has decided to sell the two saddle tank, six-wheeled, narrow gauge switchers; they are Rhode Island build, and Mr. Jones says he is loth to part with them, they are so satisfactory, but concludes that it is cheaper to sell them and buy new ones than to widen them out.

On a certain Eastern road hot boxes developed on leading trucks of three new engines fresh from the works of a leading locomotive builder. A run of thirty miles warmed them dangerously. The cause was found to be, trucks on all three, three-eighths of an inch out of square. What excuse is there for this rule of thumb way of treating a matter of such great importance? Is it any wonder that our engines jump the track, and that wheels run to the flange and ruin themselves? The day for this sort of carelessness ought to have gone by.—*Nat. Car and Locomotive Builder.*

We want to know something about the plan of running locomotives continuously, or chain-ganged. Now let's have a few facts and arguments for and against—opinions are worthless. What object is there in double crewing? Does it pay? How can the running repairs be kept up, and how shall responsibility for defects and breakdowns be fixed? Let us hear from all with experience.

The weather prophets predict a winter that will test the car heaters.

The Pennsylvania road are putting brake beams and shoes each side of all wheels in four-wheeled passenger coach trucks. This calls for sixteen brake shoes per car, but they wear only half as fast as when eight are employed, and are easier on the truck, as they "squeeze" the wheels, instead of trying to shove all four of them to the center of the frame.

Last year the average price paid for hauling freight in the United States was 970 of one cent per ton per mile, and passengers paid an average of 2.17 cents per mile fare.

H. K. Porter & Co. Locomotive Works, at Pittsburgh, Pa., have voluntarily reduced the hours of labor in their shops from ten to eight, pay to remain the same. This firm also distribute a large amount of money annually on the profit-sharing plan. It must pay them to have contented and interested workmen.

The old 17x24 8-wheelers on the N. Y. C. & H. R. haul an average of 35 loads each way between Buffalo and De Witt—304 miles for the round trip—and burn about seventeen tons of coal. The new 19x26 moguls haul an average of 45 loads, and only get away with 18 or 19 tons of fuel.

On the Great Western road in England the engineer and firemen get $2\frac{1}{4}$d., or $4\frac{1}{2}$ cents, American money, per mile; this is about as high as the average pay on Eastern roads in this country, but no comparison to wages paid in the West.

Last year the State railroads of Prussia earned $10,600 per mile. The Pennsylvania beat that—$16,000.

Last year the actual dividends paid on railroad stocks amounted to $82,110,198.

It cost almost 67 per cent. of the earnings to operate our railroads last year.

The Canadian railway system has increased from 7,596 miles in 1881 to 13,324 on June 30th, 1889 Of this mileage 9,505 are controlled under three managements the Government—1,363 miles, the Canadian Pacific—4,073 miles; and the Grand Trunk—3,179 miles, leaving 3,819 miles under other control. The earnings per mile are very low, $3,337; the only lines of large earnings being those between Buffalo and Detroit, which handled a heavy American traffic. Deducting these, the average earnings of the Canadian system are some $2,650 per mile. The train miles per mile of road have decreased from 3,760 in 1881 to 3,074 in 1889, because of the large mileage constructed in thinly populated districts The inhabitants per mile of road are 383, against about 400 in the United States.—*Ex*

The Johnson Railway Signal Co., of Rahway, N. J., are building the apparatus for completely interlocking and blocking the Erie yard at Jersey City, N. J., from the dock to Bergen hill tunnel. One of the towers will contain a fifty-six lever machine, the largest they have built

Our correspondent who asked how to get an engine in with both water hose pulled off, writes to say that he wants some one to tell how to get in alive, provided both goose necks are broken. Can any one tell him?

The Wisconsin Central are rebuilding some light eight-wheelers for suburban work, the frames will be extended back to carry the tank, and there will be one double truck under it, just like the engine truck and the same distance from the drivers. It will be a very neat and serviceable engine.

There are in the United States 1 5 miles of railroad tunnels, 17,042 miles of wooden bridges, 8,185 of stone, 11,838 of steel and iron, and 3,535 of combined wood, stone and iron, making a total of 40,600 miles of bridges.

There were 1,064 new locomotives put in service in this country in 1889.

BALDWIN LOCOMOTIVE WORKS.

ESTABLISHED 1831.

ANNUAL CAPACITY 800

LOCOMOTIVE ENGINES,

Adapted to every variety of service, and built accurately to standard gauges and templets. Like parts of different engines of same class perfectly interchangeable.

Broad and Narrow-Gauge Locomotives; Mine Locomotives by Steam or Compressed Air; Plantation Locomotives; Noiseless Motors for Street Railways, Etc.

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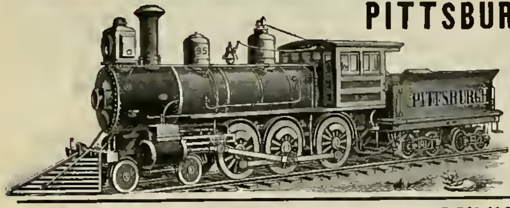

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For Broad or Narrow Gauge Roads.

From standard designs, or according to specifications, to suit purchasers.

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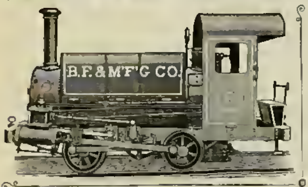
WILSON MILLER, Pres. and Treas. D. A. WIGHTMAN, Supt.



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EXPERT ENGINEERS, DESIGNERS AND BUILDERS OF

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WITH OR WITHOUT LINKS.

Very simple in construction, and adapted to STAND HARD WEAR and TEAR, and especially in the dirt and dust of Coal Mines.

WIRE ROPE HAULAGES,

FOR COAL MINES AND TRAMWAYS.

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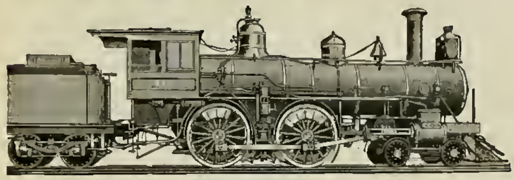

DICKSON MANUFACTURING CO.,

SCRANTON, PENN.

Locomotives of every style and size, Standard and Narrow Gauge, made to Standard Gauges and Templets. Also for Plantations, Mines and Logging.

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BUILDERS OF

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FOR EVERY VARIETY OF SERVICE.

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for Street Railways, Tram Roads and Mines.

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BUILDERS OF

Light Locomotives & Noiseless Steam Motors.

Send for New Illustrated Catalogue, containing information useful to every Locomotive Engineer or Railroad Man. **Mention this Paper.**

THE RICHARDSON AND THE ALLEN-RICHARDSON

BALANCED SLIDE VALVES.

Used by 140 Railroads. 4,000 Locomotives Equipped. Great saving in wear of Valves, Valve-Seats and entire Valve Motion.

MANUFACTURED COMPLETE FOR ANY LOCOMOTIVE.

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TIRES

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WINTERTON METAL POLISH.

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Class A, for Hot Brass, Copper, Nickel, etc. Class AA, for Cold Brass, Copper, Nickel, etc. Class D, for Finished Iron and Steel.

Send 10 cts. for Samples. Try it.

Specially adapted for Locomotive Work.

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CORRUGATED COPPER GASKETS

For all Pipe Fittings and Unions, whether for Steam, Water or Air. Can be used wherever any gasket can be applied, with better satisfaction and greater durability than any other. **Will not leak, rust, stick, burn or melt.** All sizes and shapes, ⅛ to 42 inches. In use on N. Y. & N. E. R. R. and others. *Write for particulars*

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THE LOCOMOTIVE ENGINEER.
DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 11. NEW YORK, NOVEMBER, 1890. $1.00 per Year or 10c. a copy.

The New York Air-brake.

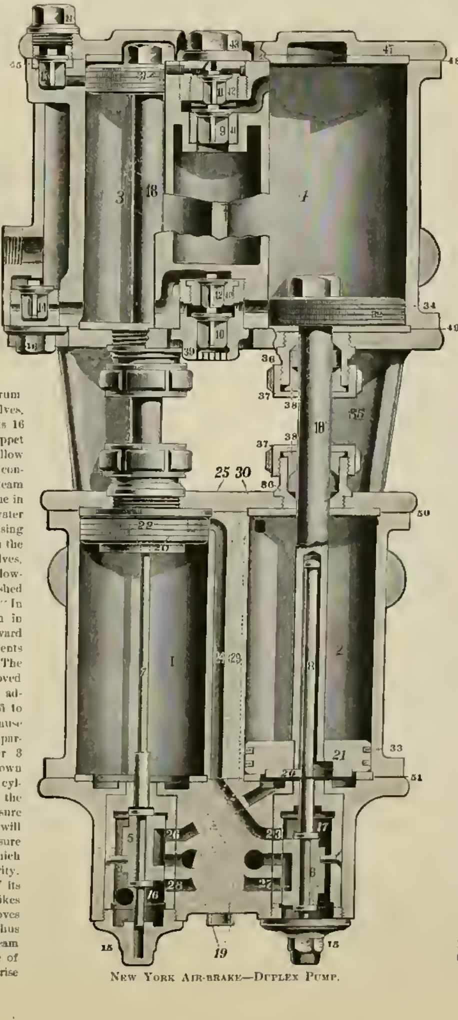
The New York Air-brake Company is a new corporation, formed principally inside of the Eames Vacuum Brake Co., who are now putting upon the market an automatic air-brake system, interchangeable with the Westinghouse, but having some new features, the principal parts being shown in our illustrations in this issue.

The air-pump is double, having at the bottom two five-inch steam cylinders, one of which moves an air piston 8" in diameter and the other an air piston 5" in diameter.

The large air piston pumps air from the atmosphere and delivers it under pressure to the smaller cylinder, which compresses it to the desired pressure and delivers it to the main drum.

The steam valves are plain slide valves, numbered 5 and 6, working in chests 16 and 17, and are operated by the tappet rods 7 and 8, extending into the hollow piston rods. The valve on one side controls the admission and exhaust of steam from the opposite cylinder, as is done in the well-known Worthington water pumps. This plan admits of the using of plain valves, and does away with the use of steam-actuated piston valves, common to other pumps. The following description of the action, furnished by the builders, will make it clear "In the position shown the air piston in cylinder 4 has completed its downward stroke and compressed its contents through valve 12 into cylinder 3. The plate 20 on steam piston 21 has moved valve 6 to its lowest position. This admits steam through port 23, 24, 25 to upper side of piston 22, and will cause the piston to descend and expel the partially compressed air in cylinder 3 through valve 14 and passage shown into the reservoir. Meanwhile, the cylinder 4 has become filled above the piston with air at atmospheric pressure through valve 9, and the cylinder 3 will be filled with air at atmospheric pressure through valves 9 and 11, both of which open inward and are seated by gravity. When piston 22 reaches the end of its downward stroke, the plate 20 strikes the tappet on valve stem 7 and moves valve 5 to its lowest position, thus uncovering port 26 and admitting steam through port 26 to the lower side of piston 21, thus causing piston 21 to rise and compress the air which is in cylinder 4 through valve 11 into upper part of cylinder 3. Just as piston 21 completes its stroke its plate 20 strikes the tappet on valve stem 8 and moves valve 6 to its highest position, uncovering port 27 and admitting steam through port 27 to the lower side of piston 22, causing the piston to rise and expel the partially compressed air in cylinder 3, through valve 13, into passage shown, and thence into the reservoir. While the pistons are compressing the air above them into the reservoir, the air cylinders below the pistons will be filled with air at atmospheric pressure through valves 10 and 12, ready for another cycle of operation

"The 5-inch duplex air-pump will, in a given time, compress as much air as the ordinary 8-inch air-pump, with the consumption of but 60 per cent. of the quantity of steam. The air valves are simple poppet valves, which seat by gravity, while the pistons wait, and therefore are not liable to pound themselves to pieces. All the parts of the pump have been made so as to be durable and easily accessible, steam and air valves may be examined by unscrewing plugs, without taking down the pump."



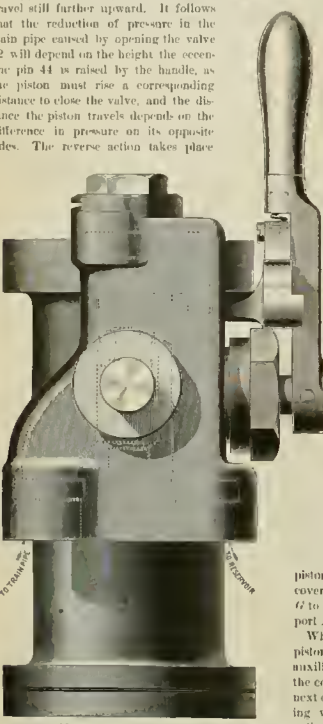
New York Air-brake—Duplex Pump.

The illustrations on page 202 show the engineer's valve, which is entirely new. The operating handle stands up perpendicular in the running position, and is pulled back for application, and pushed ahead for release.

The sectional view shows the side, and its operation is as follows:

The chamber above piston 32 is connected with the train pipe, and from it reductions are made to set the brake, the chamber below the piston is connected with the engine drum all the time

The space above valve 39 is also connected with the engine reservoir. Valve 39 regulates the flow of air from the reservoir to the train pipe Valve 42 regulates the discharge of air from the train pipe Lever 43, which is fulcrumed on eccentric pin 44, is for opening valve 42 Lever 49 is for opening valve 39, it is actuated by lever 48, by means of the slot and pin 48. The opposite end of lever 43 is controlled by piston 32. To apply the brakes, the handle attached to the spindle that carries the eccentric pin 44 is turned to the right, this raises the outside end of the lever 43, and with it valve 42, thus allowing air to escape from the train pipe. As the pressure is reduced above the piston 32, the reservoir pressure tends to raise the inside end of lever 43, and allow valve 42 to close, and stop the escape of air from the train pipe. If the eccentric pin is raised but a little, the piston will have to rise but little to close the valve; if it is raised higher, the piston will need to rise higher to close the valve, and consequently will allow more air to escape from the train pipe before the valve closes. This piston is made automatic in its action by means of the bell-crank 34 and spring 33. The pressure of the spring holds the piston down as long as the pressures on both sides of the piston are the same, but with a very short leverage on the bell-crank; the piston is connected with the bell crank with a much longer leverage, so that a very slight difference in pressure on the piston will allow it to start upward, but as it moves the piston, the piston leverage decreases and the spring leverage increases, until an equilibrium occurs and the piston stops; a further reduction on the upper side of the piston will cause the piston to travel still further upward. It follows that the reduction of pressure in the train pipe caused by opening the valve 42 will depend on the height the eccentric pin 44 is raised by the handle, as the piston must rise a corresponding distance to close the valve, and the distance the piston travels depends on the difference in pressure on its opposite sides. The reverse action takes place



ENGINEER'S VALVE—BACK VIEW SHOWING PORTS.

when the handle moves the eccentric pin downward. This action opens valve 39 and allows the air to pass from the reservoir to the train pipe, but as the piston descends in proportion as the pressure below it, the lever 40 will be drawn away from valve 39 as soon as the piston has descended a distance corresponding to the movement of the eccentric pin by the handle. Thus, by stopping the handle at any desired point, an excess pressure may be carried, more or less, as is desired

You will understand that when valve 42 is opened to reduce the air in the train pipe for a service stop, it remains open until closed by the action of piston 32, which closes the valve gradually and performs the same functions in preventing the concussion of air from the rear of train from releasing the forward brakes, that the equalizing discharge valve of the Westinghouse does.

The amount of braking done depends upon the distance the handle is moved; the engineer simply moves the handle and leaves it there, the reduction takes place at once, and the piston closes the exhaust valve automatically.

On page 203 will be found a sectional cut of their quick-action triple valve; for engines and tenders they use a plain valve—one without the quick-acting mechanism.

This valve is not far different in principle from the Westinghouse valve, but differs in detail.

Connections are made with the auxiliary reservoir, the brake cylinder and the train pipe, as shown in the illustrations, piston 2 actuates slide valve 4 and graduating valve 5. The stem 6 of valve 5 is arranged to slide in the stem of piston 2, so that valve 4 may be closed before graduating valve 5 is opened. The slide valve can remain stationary while the piston 2 returns part way and closes graduating valve 5, as the abutments that move valve 4 are farther apart than the length of the valve.

Air passes from the train pipe to the drip cup *A*, through port *D* to the cylinder *E*, moving the piston 2 to the location shown by the cut; this uncovers port *F*, and allows air to pass through port *G* to the valve chamber *H*, and through the upper port *B* to the reservoir

When the train pipe pressure is reduced the piston 2 moves its full stroke, first shutting off the auxiliary reservoir from the train pipe by closing the connection between passage *F* and cylinder *E*, next closing exhaust valve 4 and opening graduating valve 5, which will admit air to the brake cylinder. If the train pipe pressure is reduced but little, the pressure in the reservoir is soon reduced to less than the train pipe, and the piston 2 starts back and closes graduating valve 5 without disturbing valve 4, which is held with some force by the air pressure, and checks the return stroke when valve 5 is seated A further reduction in the train pipe would repeat the same action and apply the brakes a little harder If the train pipe pressure is reduced eight or ten pounds the graduating valve 5 will remain open and the brakes go full on, as for a service stop An increase of pressure in the train pipe will cause all the valves to move back to the position shown in the plate, thus releasing the brakes and allowing the reservoir to be re-charged.

In all service stops the quick-action valves, shown below the triple, remain inoperative, but a quick reduction of 15 or 20 pounds in the train pipe pressure causes valve 14 (which is a piston exposed to reservoir pressure on one side, and train pipe pressure on the other side) to open and admit pressure through *K* above piston 17, which then opens valve 19 and allows air from the train pipe to pass check valve 21, and enter directly into the brake cylinder through passage *C*, thus quickly reducing train pipe pressure to actuate valves on succeeding cars, and at the same time applying the brakes with a greater force than would be possible if the brake cylinder received air from the reservoir only. An increased pressure in the train pipe causes all the valves to return to the position shown and release the brakes.

The mechanical details of this brake were worked out by Albert P Massey, mechanical engineer of the company. The preliminary tests have been continued over a long period of time, and the brake is actually at work on several roads. The address of the company is 115 Broadway, this city

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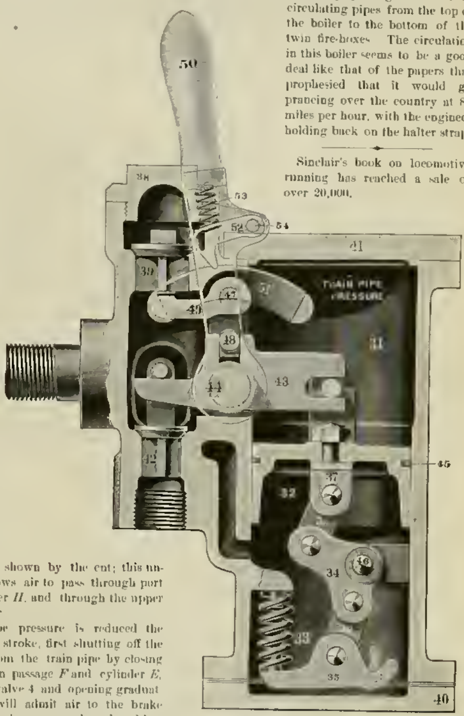
Trouble having been found in the circulation of water in the boiler of the Strong locomotive on the Santa Fe, Supt. of Machinery, John Player, has improved it materially by putting a number of circulating pipes from the top of the boiler to the bottom of the twin fire-boxes The circulation in this boiler seems to be a good deal like that of the papers that prophesied that it would go prancing over the country at 80 miles per hour, with the engineer holding back on the halter strap.

Sinclair's book on locomotive running has reached a sale of over 20,000.



ENGINEER'S VALVE—SECTIONAL VIEW.

Reporting Work, and Kicking on Changes.

When you report work be sure that you know just what you want and the engine needs.

Don't repeat history for the four thousandth time by booking "valves faced" when the fact is that the valves are in good condition and the cylinder packing needs attention.

Men who ought to know better often make themselves ridiculous by such work—if work it can be called. We call to mind the case of a certain engineer running out of a city where a large locomotive works are located. The road had some new locomotives built and tried a different make of injectors than the "standard," the first one fell to the lot of this engineer, and before he went out he took occasion to kick about the new injectors—he was used to the other kind, and, besides that, the makers had given him a patent oil-can and nickel-plated torch. The new injectors somehow got water into the boiler all right until the fourth day, when they refused to work—much to the satisfaction of our kicker friend.

"I told you they wan't no good," said he, "now they are bucking and no one knows where to look for the trouble, with the old ones we had no trouble, these new-fangled things are built on the wrong principle."

The road had not yet accepted the engines, so the M. M. sent word to the superintendent of the works to come over. When he arrived and heard the complaint he asked for the engineer, to see if he could tell from the way the instruments acted where to look for the trouble.

No satisfaction could be got from the runner, he ended all his remarks with: "They ain't no good, and the way to fix them is to take 'em off and put on the old squirts."

The superintendent got a machinist to take down the steam valve and found coal in the combing tube and the delivery choked with it, then he took down the water hose and found no strainer there.

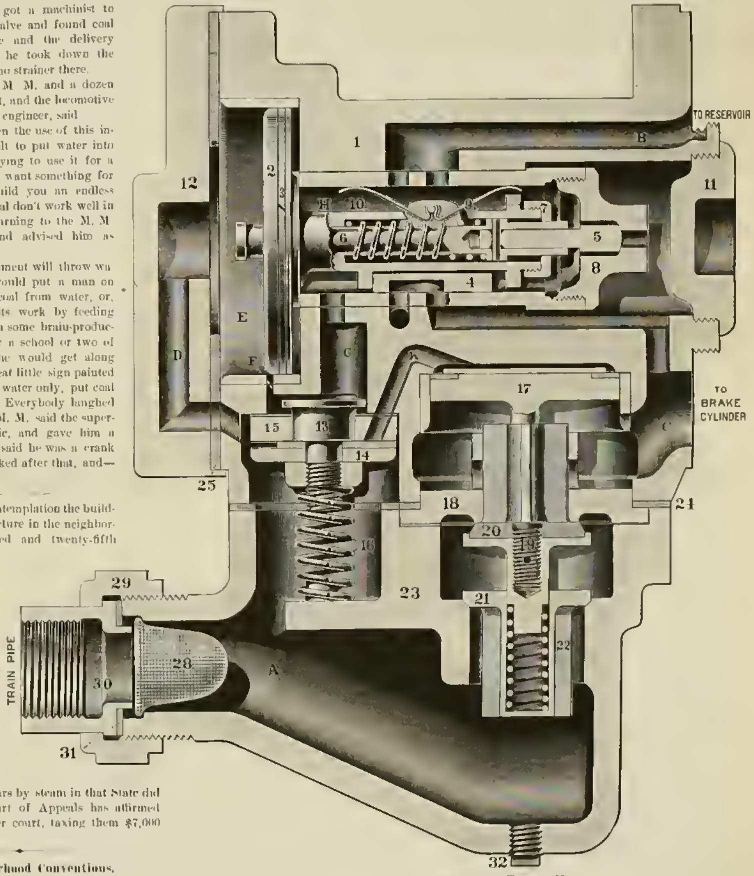
The kicker and the M. M. and a dozen other men were present, and the locomotive builder, turning to the engineer, said:

"You have mistaken the use of this injector, sir, it was built to put water into the boiler, you are trying to use it for a coal conveyor; if you want something for that purpose we'll build you an endless chain with buckets, coal don't work well in an injector." Then turning to the M. M. he bowed politely and advised him as follows:

"I think this instrument will throw water all right if you would put a man on to run it that knew coal from water, or, you might improve its work by feeding the man in charge with some brain-producing food, like fish—say a school or two of whales—or, perhaps he would get along with it if you had a neat little sign painted over it, reading, 'For water only, put coal in with the scoop.'" Everybody laughed but the kicker. The M. M. said the superintendent was sarcastic, and gave him a cigar, and the kicker said he was a crank—but the injector worked after that, and—this is a true story.

Jay Gould has in contemplation the building of a very fine structure in the neighborhood of One hundred and twenty-fifth street for the free use, as library, gymnasium, etc., of the elevated railroad employes. He could well afford to make this the best building of the kind in the city.

The N. Y., N. H. & H. runs less than fifty miles in the State of New York, and claimed that, in its case, the penalty for not heating cars by steam in that State did not count. The Court of Appeals has affirmed the order of the lower court, taxing them $7,000 in fines.



QUICK ACTION TRIPLE VALVE.

The Brotherhood Conventions.

The firemen convened this year at San Francisco, and the engineers at Pittsburgh. The reports of the officers of both orders show a flattering condition of the financial departments, and increased membership and new lodges seem to be the order of the day. The firemen increased the salaries of all their grand officers $1,000 per year, and unanimously re-elected E. V. Debs secretary, treasurer, and editor of the magazine.

At this writing, the engineers are still in convention, and the prospects of quite a scramble for the two grand offices to be filled, promising.

The agitation of the federation question is still an engrossing theme, but the anti's, so far, seem to be in the majority, headed by Grand Chief Arthur.

There was some pretty fair speaking indulged in at the opening exercises, the local dignitaries, as usual, told the boys how brave they were, how much more nerve it took to die with the hand on the throttle, and the eye on the rail, to the music of escaping steam, than to face a row of brass cannon, headed by a string band and a drum major—the railroad hero is a laborer until he is killed, then his role of hero is assumed. Chauncey M. Depew gave the boys a good speech, and they encouraged him with applause, but while he was telling how many hundred times the engineers had come to him to correct some wrong, and how quick he saw the point, and how quicker he granted the request, we were wondering how it is that so bright a man as he did not himself see the wrong first and apply the remedy, instead of waiting for the committee. When has a high official offered to change a thing for the benefit of the men until requested to do so? Would not a spirit of justice offer to correct a wrong when discovered, be it on the one side or the other?

There were many delegates at Pittsburgh who favored biennial sessions, as the firemen have, and some had figured up statistics going to prove that it cost the order $6 per minute to hold the convention—it takes a good many engineers running for three cents per mile to earn $6 per minute.

The committee of arrangements are to be complimented on the able way they handled the entertainment of this large body of men. Chairman F. K. Adams is especially worthy of praise for the way he introduced the speakers, and the way he did *not* inflict the audience with letters of regret, and his omission of flowery speeches of his own—he simply introduced the speaker by name and title, and turned him loose. Most chairmen take occasion to smuggle a speech of their own into the audience between each act. We never attempted to make but one speech, and then the chairman prefaced us by fifteen minutes of rot—some of the very things we meant to use—and as we bowed and waited for him to quit, we forgot our speech, age, name, and previous condition. The man wrote our oratorical obituary, and choked off another Clay or Webster from the halls of Congress.

The latest news from the convention is that the plan of general federation has been defeated. That the office of assistant to the Grand Chief has been created, and A. B. Youngson, of the Erie, elected to fill the place—the proper and graceful thing would have been to make the office appointive. T. S. Ingraham was re-elected F. G. E. The election of second grand engineer had not taken place.

The Woolf valve gear on engine 18, Manhattan elevated road, this city, has not done as well as was expected of it, nor as well as the link motion, therefore it goes.

The monthly pay-roll of the C. & N. W. is said to be $1,200,000.

New Form of Tender.

A correspondent who signs himself G. L. W., in the *Northwestern Railroader*, offers the form shown by the cuts for locomotive tenders. His plan has several advantages, and one or two disadvantages, but seems on the whole to possess considerable merit. Fig. 1 is a plan, and Fig 2 a side elevation of his tender, and make the construction plain.

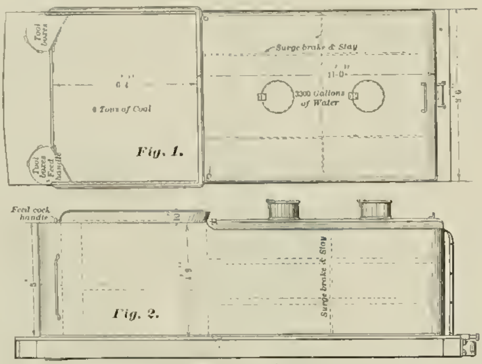
He proposes to make the coal pit the full width of the tender, and all in front with a flange around it alone. The water tank is located entirely behind the coal pit, and has round corners and a crowning top, this prevents the collection of coal and cinders there, and the consequent rusting out and pitting of the tank He has two manholes for taking water, to save too fine an adjustment in setting the engine at the tank.

The water valves are back of the coal pit, and operated by rods running through pipes along the sides of the flange.

Just why he should narrow up his gangway end of the pit to the old size and shape by that particular form of tool-box is not plain.

The fireman would certainly have more room in this form of tender; he would have no coal shoveling from the top of tank, no troublesome back deck to clean, and no water in his coal pit.

With this form of tank the area of water tank exposed to the action of the pitting compounds formed in wet coal, and the cutting action of large coal is reduced to a minimum. This plan places the weight of the coal all on the front truck, and most of the weight of the water on the back one; the coal is used out slowly, while the water goes fast and is often replenished. When near the end of a run that would nearly exhaust the coal, a tank of water would put an immense load on the back truck, and the front truck, being relieved of nearly all its load, would be high on its springs, with the chances in favor of pretty unsteady riding. One other possible objection is in the extra long goose-neck, and the danger of freezing; still, a heater is required on the shortest of them in freezing weather, and this plan has an advantage in that the goose-neck joint is behind the front truck, where it can be easily got at. If this form of tender should become popular, what is the matter with having the coal pit and the water tank two separate and distinct pieces, so that one could be taken off and repaired or replaced, regardless of the other? This would do away with all trouble with pitting and rusting tanks, do away with the necessity of taking coal off an engine to calk her water-tank, and would certainly be a cheaper tender to build than the present U form; the water tank could be easily kept painted outside, and it would be a simple, square box to build and brace.



A NEW TENDER DESIGN.

The Swinerton flat-spotted driving wheels have lost more friends. The second pair tried on the elevated had smaller flat spots than the first one—to stop the noise—but they were so small they didn't count, and the men did not know they were under the engine until told—and she slipped just the same. The project of lengthening all the station platforms, and hauling seven cars—five with the engine and two with the spots—has been abandoned. What next?

The Westinghouse Air-brake Co. have completed the removal of the entire plant from Allegheny City to their magnificent new shops at Wilmerding, Pa. The general office of the company will remain, as heretofore, in Pittsburgh, and the old shops will be occupied by the Fuel Gas and Manufacturing Co., another Westinghouse concern. The new shops are in full blast, and by their use the output is very largely increased, and it needs be, for the demand for power brakes was never greater.

Mount Clair Shops of the Baltimore & Ohio.

As is well known to most of our readers, the B. & O. was one of the pioneer roads of America. It used some of the earliest and crudest forms of locomotives, cars, tools and track appliances—and has not thrown them all away.

A MUSEUM.

Probably there is not another shop on the American continent that makes a nearer approach, on so large a scale, to a museum of antiquity than these same shops, located, as they are, within the corporate limits of the chief city of Maryland.

BIG, BUT SLEEPY

The B. & O. is a gigantic system, the owners of one of the most valuable and extensive franchises in the country, but comes a long way from being a model road.

Its lines reach from New York to Chicago, and, radiating from Baltimore, cover a vast extent of territory, the very heart of the coal, coke, iron and oil industry of the nation. In all, they own or control 2,954 miles of track, and pull 27,000 cars of their own, with 780 engines.

Before the war it was the best road in the Union, and its reputation then is still quoted by its friends. It is safe to say that, had this great property been in the hands of a progressive management, like the Pennsylvania, it would have been to-day a four-track, stone ballasted road from end to end of its main lines, instead of the single track, crooked, rough-and-ready line that it now is. Between Baltimore and Philadelphia they have a fine road bed, but west of Baltimore it is simply horrible, in comparison with other lines in the same field.

INADEQUATE APPLIANCES.

The most primitive of switch targets are used, and many of these are without lights. Accidents, especially to freight trains, are regular, and appalling in their magnitude. This is partly due to bad track, but more to bad equipment.

CALAMITY CARS.

They haul a class of coal cars carrying a twin hopper made of iron. These cars have no through sills, except the outside ones. No decent draft rig can be used. They have no continuous brakes, and you will see just as many in bad order, in a trip over the road, as you will in good. The hoppers freeze up in winter, and refuse to dump, and rough handling disables the dumping gear. You can see them by the half dozens with the draw-heads gone and chained together These cars have a peculiar rigid truck that materially assists in their destruction when they get off the track—a condition in which they seem to delight

THE SHOP BUILDINGS.

The Mount Clair shops are a series of old buildings, long in use as the big shops. Most of them are as dark as dungeons, and the older of them have basements partially lighted by side pits. There are, however, some new buildings

One of the latter is the office building, containing on the upper floor the testing department, the superintendent of machinery's office, and the

DRAWING-ROOM.

This room is the lightest, cleanest, best managed, and most modern department about the shops. It is under the charge of chief draftsman F. J. Cole, who has everything in good shape, and maintains a system in caring for his drawings and in the issuing of blue prints, which is done on the card system. The older drawings of this road were, unfortunately, long ago destroyed, but everything since 1850 is carefully preserved. Some of them are signed by M N. Forney, who, long years ago, was chief draftsman here.

A ROUND TOWER.

A short distance back of this building is a new round shop, for passenger car work. This building is not above five years old, but just why it was made in the shape it is no one seems to know. Its side walls are very high, and its great, dome roof rises at least fifty feet above the floor. All around the sides of the building are arranged heater pipes, but how such a building can be made comfortable in freezing weather is not plain. The tracks radiating from the center are none too long for coaches, and it seems to be rather an unhandy affair all around

THE PAINT SHOP,

for coaches, is located in an old building with a basement, the latter used as a paint and varnish storeroom. The paint shop is very dark and very illy ventilated, although some attempts have been made to improve this by conducting small tin pipes from the roof down to within a few feet of the car tops, where they flare out into bell-shaped hoods. These are too low. Light and ventilation could better be secured by using a transomed roof The fumes of fresh paint and varnish were strong enough to kill birds that happened to get into the building, and were shut in for the night, before the new ventilators were added.

THE MACHINE SHOP

and erecting shop are old, dark, and filled with ancient, infirm, crippled and decrepit tools. Here and there a modern tool is to be seen, but they are lost in the general air of age and decrepitude

FROM ANOTHER AGE.

Old chain-feed lathes are there, and at work, worn until the carriage looks like a scrap of stove plate, patched, scratched, jammed and bungled There are two large lathes of home manufacture that have stone beds and stone head-blocks. Their V's are slight strips of iron, laid on a granite block. We never knew before that the machine tool business reached back into the stone age.

CAMELS AND GRASSHOPPERS.

Most of the locomotives in the shops were no better or no more modern than the tools, still the road has a goodly lot of first-class engines. Old camel backs, without trucks, lagging or jackets, were in, getting extensive repairs. One grasshopper was being thoroughly rebuilt, and more of them are in use in the yard around the shop These engines were built in 1835, and their age and service is greatly praised here, and it is remarkable, yet it is not at all likely that there is an original piece in any of them. They look comical, walking around the yard with their grasshopper legs up in the air, their exhaust through an independent pipe, and the water tank setting straddle of the fire door.

PRIMITIVE FROGS.

In this large yard they use cast-iron frogs, with loose tongues, and no targets or levers to operate or hold them in place. The switchmen kick the tongues over with their feet, or pry them over with a stick, and then they are free to flop around under cars being moved across them, and spread trucks around in a promiscuous and careless fashion—a trick they play daily This form of frog belongs to the grasshopper engine age, and the road will probably discard them together—it wouldn't be right to part them now.

THE BOILER SHOP

has some new tools, and does better work than the average. A new shop is being fitted up for this department, that will have a crane and hydraulic riveting plant. In all their longitudinal seams they use a butt joint, and inside and outside welts. At the fire-door they flange the inside, or fire-box, sheet out enough to receive a line of rivets. The outside sheet is left straight, and the hole for the door about two inches larger than that in the inner sheet. To the outside of this sheet is riveted an angle iron ring, and to the angle iron a ring of square section, the rivets also holding a half-inch thick copper ring, extending from the outside to the inside sheet. This makes four joints instead of one, but it is claimed that it pays, as it is so easy to get the copper ring out for repairs.

NEW LOCOMOTIVES.

They are building a number of 21x26 consolidation engines here, the mates of others of the same size now in service. Baldwins are also building them some heavy passenger engines, with 21x24 inch cylinders. They will have 60-inch boilers, which is none too large for the cylinder. They turn out an average of four new locomotives per month, and repair four or five times that many.

IMPROVED GRATE ARRANGEMENT.

Shallow fire-boxes, with a decided drop in front, are extensively used here. This dropped front gives some 24 inches between the grates and the lower rows of flues, and the incline is provided with shaking grates, like the rest of the furnace, making it easy to maintain a clean fire ahead. Where axles come under ash pans, they put a lining of asbestos on the ash-pan to protect the axle from heat. The grates used are straight bars running across the fire-box, and having an open slot through the center. These give about 60 per cent. of opening, and do not cock and burn off so easily as finger grates.

A HEAVY TENDER TRUCK.

In some new tender trucks they will bolt independent cast-iron pedestals upon an upper frame. The faces of the pedestals will be chilled, and no machine work put on them, a floating box used. The frames will be extra heavy.

CONTROLLABLE RELIEF VALVES.

On freight engines they put a large plug cock in the steam chests and connect it with a lever like the cylinder cock lever. This is very useful when switching, as the engine can be reversed and the stop graduated by the amount of opening given to the plug in the chest, as it allows more or less compressed air to escape; not as good as driver brakes, but better than nothing. The cock can also be used as a relief valve when desired.

PONY TRUCK KINK.

They use a steel bush in the back end of the radius bar to pony trucks. This bush is held by a set-screw, and can be taken out and replaced in a few moments. This would seem a good practice to follow, as all roads using pony trucks have to upset the eye of radius bars more or less often.

PATCHING.

In the back shop we noticed a machinist fitting a half-inch brass plate on the side of a driving-box. The plate was the full size and shape of the box, and was held on by about fifteen tap bolts of brass or copper. No doubt a new set of driving boxes could be made for the money expended in doing a poor job of patchwork on the old boxes.

MAKING TEMPLATES.

Last winter a template room was established, and some nineteenth century mechanics put to work getting up templates for standard forms. This they are doing in a very thorough and substantial manner, yet the road would be better off and their work greatly simplified if a good many of the "standards" were scrapped.

ROUNDABOUT VALVE MOTIONS.

There are on the road a lot of eight and ten-wheelers known as the Perkins engines; they are improvements on the grasshoppers and camel backs, but they are peculiar—devilish peculiar. The ten-wheelers have a link motion employing two sets of rockers, and two extra connecting rods on each side—a sort of a back-action affair that there seems no very good excuse for, still they are accounted very fair engines, when a little aged they must have a wonderful amount of lost motion.

INGENIOUS SPECIAL TOOLS.

In one of the shops there is a very efficient oil tester, designed by a former chief draftsman; in the tool-room there are also a pair of machines of his design, for twisting and cutting wire for car seals, the work being done automatically and fast, before the invention of this machine, they used to make twisted wire seals by taking long strands of wire the length of the shop, and twist them by hand, cutting the lengths with a pair of shears.

SIDE RODS.

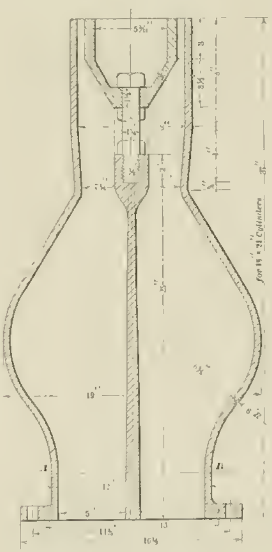
All kinds and shapes of side rods are in use here, but solid ended rods are put on all new 8-wheeled engines.

PECULIAR SPLIT ECCENTRIC.

On some classes of engines they use a split eccentric that carries a collar on its side; the halves are held together by bolts through lugs on this collar, a cheap but clumsy rig, and very efficient where there is room to get it in.

REFORMED CAMELS.

Engines for driving the shops have been built from time to time, some of them converted from



A., T. & S. F. NOZZLE.

camel backs that had been unfortunate on the road; these shops, in times past, also built many of their machine tools.

EASILY-HANDLED THROTTLES.

On engines where the boiler comes through the cab, a throttle arrangement is used where the stem goes down into top of boiler, and turns in its packing instead of sliding lengthwise, they are neater than any pipe arrangement to the dome, and handle better.

On cars they are using some M. C. B. couplers, but experience heavy brakage.

MODEL SWITCHERS.

They have recently turned out some heavy six-wheeled switchers, that are as neat and modern as can be found, they are handy and well proportioned, they weigh 100,000, and the weights on the forward and back wheels are within fifty pounds of balancing, no better examples of good design are to be found.

AN ICE TRUST.

In passing through the shop we noticed on a water-cooler a sign "For subscribers only"—the men have to pay for their own ice.

JUNK.

The yards of these big shops seem crowded full of material of little or no value except as scrap, and it looks at first glance as if little is sold, and there was enough on hand to buy a few new engines, if turned into cash.

ONE CHANCE LEFT.

Certain it is that the railroad world has grown clear past this shop, its tools, and much of its power. A change must come over the spirit of its dreams, or it will never be a half-way modern shop, it needs a clean-up, modern buildings, an exodus of ancient tools to the cupola, old engines to the scrap heap, the scrap heap to the junk shop, and a management with money, and energy, and ability to refit and reform; but they can't do this without expense, and perhaps nothing human will soon make a marked change; it will needs be something unusual—say an earthquake.

An Annular Exhaust Nozzle.

The accompanying cut shows a form of exhaust nozzle now being experimented with on the A., T. & S. F. As will be seen, it has a large chamber or reservoir in the pipe, and a spreading plug in the top. The size shown is the one used for 18-inch cylinders, and the sizes given on the drawing are sufficient explanation. It is reported that engines run with a very much larger opening with this nozzle than they do with the plain one, but we are inclined to think that it will cause a very perceptible back pressure on the opposite cylinder.

The Erie employes have not yet answered President King's letter replying to the demands of the grievance committee. He says, with one or two exceptions (that are stated and a remedy promised) the men receive better wages than those on other lines in the same field. His argument that no better wages can be paid on account of the cut in freight and passenger rates is a bad argument—the road's management should do something to restore and maintain rates. His answer to their demands that the road hire no conductors at all, but promote them all, and to hire as many outside engineers as they promote firemen, is right and just. The road is responsible through its officers to the public, and any rule that puts the discipline of the men or the chances of selecting the best and discarding the worst out of the hands of the operating officers means a demoralized and incompetent train service. There are many abuses that the men are subject to that can be corrected, and should be, but the broad one of wages, and the narrow one of deciding who and what the men in service should be, it would not seem policy to go to war over just now.

We are in receipt of the report of the 23d Annual Convention of the Am. Ry. Master Mechanics' Association. The report is gotten up in Secretary Sinclair's usual tasty style, and has a valuable addition in the shape of a brief description and illustration of all the standards so far adopted by the association. This feature is of great value, as it keeps the standards before the members without the necessity of going back in the files to hunt them up; then, again, many new members have not got the complete reports.

The secretary is hard at work upon the complete index for all the reports, covering twenty-three years. This index will be valuable, and save time.

Richard N. Allen, who came up from the scoop and the throttle, the first man to use steel-tired car wheels, and the inventor of the paper wheel that bears his name, died at Cleveland, O., on Oct. 10th. He was in actual service as fireman, engineer, and master mechanic for more than a quarter of a century, and in his day saw hard times and grief, but in his own words, "made a go of it in the end."

A correspondent wishes to know something of the hours, pay and condition of the engine and trainmen on the Reading road. We do not know what their conditions are, but don't suppose their hours or pay are far different from other men in the same service on other roads. The officers of the company reserve the right to tell them what they shall and shall not belong to, when to button up their coats and how to shave—but they don't all obey, thank God.

Some Old-timers at the B. L. E. Convention.

The Brotherhood of Locomotive Engineers was not born until August 17th, 1863; before that there was an organization known as the Knights of the Footboard.

This order was merged into the Brotherhood, or died about the time the present organization was born. In 1855 the old order was at the height of its glory, and at the convention held that year at the city of Baltimore there were present ninety-five delegates.

During the past year John Brunton, of Pueblo, Col., who was at the Baltimore convention, tried to get a few of the survivors of that meeting to be present at the Engineers' Convention in Pittsburgh; it was the design of the grand officers to have the fathers of the order on the stage, but Mr. Brunton was married recently, and, like all bridegrooms, a little late in getting any place but home, and he arrived too late to make the arrangements. There were present, however, four survivors of the convention of 1855.

John Sexton, once engineer of the old Camden & Amboy road. He has been roundhouse foreman at South Amboy, N. J., for the past twenty-seven years, and has been in active service for the Pennsylvania road, or its predecessor, since 1842. He was the last man to run the "John Bull." Mr. Sexton looks able to write orders for coal-picks and emery for many years to come.

H. R. Smith was with the old New Jersey Railway & Transportation Co., and the P. R. R. got him with the road long years ago. For the past twenty-one years he has been supervisor of track for the first division out of Jersey City, and for eleven consecutive years has won the $150 prize for the best section of track on the system, and his road is over marshes and hills, too; this prize money Brother Smith always gives to his workmen. The other supervisors of track on this road are civil engineers, as a rule, and try hard to get their track up to his; he says he knows what track needs to be, from his years of experience on an engine, and they know what it ought to be by squinting through a transit —and who will dispute him? Mr. Smith was one of the seven men who, in a Jersey City roundhouse, organized the present insurance feature of the Brotherhood, and he holds policy No. 2. This insurance plan has since distributed more than three millions of dollars to the widows and orphans of dead engineers, or to engineers totally disabled. Brother Smith has been in service almost fifty years.

William Osborn commenced his railroad career with the old Transportation Company, and after ten years went with the old Morris & Essex road—now the N. Y. end of the D., L. & W. For a great many years he has been engine dispatcher at the Hoboken shops, has as many friends as the company has ties, and looks as if he would be on deck for ten or fifteen years at least. He was one of the younger delegates in 1855.

John Brunton was for many years a plug puller on the old Bellefontaine road in Ohio; he helped to build the first engine he ran, and was, like most engineers of his time, a "machinist runner." He was with the "Bee Line" for many years, and some ten years ago was given charge of the Y. M. C. A. building at the Brightwood shops. Five years ago he went to Colorado for his wife's health, and was given charge of the stationary engine of the Pueblo shops of the D. & R. G. road, where he still is. Mrs. Brunton died shortly after her arrival in Colorado, and, as we stated before, Brother B. is again a bridegroom. Some of the others of the quartette may look younger, but certainly none of them feel younger than he.

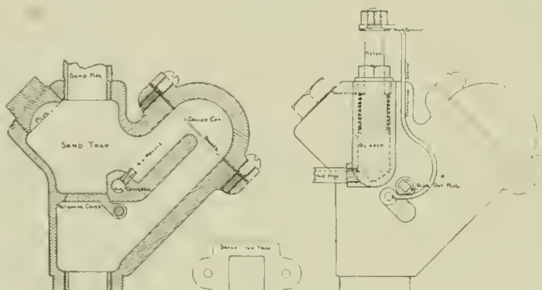
There may be several other ex delegates to the 1855 convention, but they are probably few and far between. Thirty-five years of railroading leaves only the toughest. All of them are grandfathers, or ought to be, and the color variety of hair is limited to white, in small quantities.

These men are of the pioneers of organized labor upon American locomotives, and the forefathers of the present order, just as the old Knights of the Footboard was the forefather of the Brotherhood, and we are only sorry that they were not given a place on the stage, out of respect for age and effort in labor's behalf; they cannot always be with us, and are as entitled to our distinguished consideration now as they will be to eulogy after death. We are too free with the latter and too stingy of the former.

Leach's Improved Sanding Device.

In our September issue we illustrated an air jet device for sanding rails, designed by H. L. Leach, Jr., assistant sup't. M. P. of the Fitchburg road, and in the description suggested that provision be made for using a large quantity of sand for emergency, stops and such purposes. These changes have now been made in an ingenious and substantial manner, and the new device is here illustrated.

The jet device is located in the sand pipe above the running board, and in its normal condition leaves the sand pipe free, just as a plain pipe is, and any quantity of sand can be dropped. When it is desired to feed sand automatically and in small quantity, air is admitted under the small piston shown, and this moves up, closing the trap door marked "retaining cover," and admitting air through the small jet, then, when sand is admitted to the trap it is held there, and the jet carries small quantities of it over the bridge and down the pipe to the rails. There is a chilled cap, cheaply replaced, that is subject to the sand blast cutting; the rest of the device does not seem liable to wear.



LEACH'S IMPROVED SANDING DEVICE

It is well known that any body moving rapidly through the air causes a partial vacuum behind itself; a fast moving train is a good example. The lower end of sand pipes collects moisture from the rails from this cause, and some relief has been had by placing a **T** in the pipe a foot or so from the bottom. This device ought to prevent the collection of moisture in the pipes, because air can be admitted to them and keep them blown out. The slightest pressure above the atmosphere should suffice.

This device is being introduced by H. L. Leach, 237 Franklin street, Boston, Mass.

The New Shops of the Boyden Brake.

The Boyden Brake Co., of Baltimore, have moved into their new shops at the corner of Biddle and Chester streets.

The building is a large and substantial one, two stories high, with separate power house, blacksmith shop and foundry buildings. One floor of the building is occupied by an electric motor company, the other by the brake company.

The shop is not different from other manufacturing shops of moderate size—it has a good many standard tools, and quite a number of special ones, together with many jigs and other attachments to facilitate the work. They have fifty complete brakes set up in a row, and in operation, together with driver brakes, and a complete engine equipment, the brakes operate very quickly on the whole line, the fiftieth brake being set in about three and a half seconds from the moment of application.

About the shop are located air pipes for various purposes. One use that it is put to could be well imitated in railroad shops—an inverted brake cylinder is used as a press to force bushings into work; how much quicker and easier to handle than a screw press! One of these rigs is used, with proper dies, to form the leather packing rings for air cylinders.

The Boyden air-pump will run in any position, and one is running here upside down; in this position there is less water carried into the air cylinder from a leaky gland on the steam cylinder than when the air cylinder is located at the bottom.

They have here a cheap and ingenious plan for closing the large core hole in the end of cast auxiliary drums; instead of tapping it out and screwing in a plug, they cast the sides of the hole inclined toward the inside, with a projection at the bottom, that leaves the hole smaller there than at the top; then a small cast iron disk with a beveled edge is dropped into the recess in the drumhead, being held central by a circular projection on the bottom that fits the smaller opening; around this disk they pour lead, and calk. There is no machine work at all, and a boy can make a good job of three times as many in a day as a mechanic can tap out, and put plugs in.

Their brake is in use on thirty-six different roads, in many cases on trial, but in several instances has been adopted as the standard. It interchanges with the Westinghouse, using their hose coupling.

Vote on M. C. B. Standards.

The results of the letter ballots sent out in August on the adoption of recommended standards have been announced by Secretary Cloud.

The journal box for 60,000-pound cars, and the one for 40,000-pound cars, was rejected.

The plan for loading poles on cars, the rack for loading bark, the making of standard height of passenger car draw-bars 35 inches, the safety chain for passenger cars, the fixing of the lateral angle of brake beams at 40°, and the fitting for train pipe for steam heat to be two-inch female, standard pipe thread, were adopted.

Who Told You?

The reports of the Brotherhood of Locomotive Firemen, presented at the recent annual meeting, show that the organization borrowed $20,000 from the Brotherhood of Locomotive Engineers, to help pay strikers during the Burlington strike. The loan has not been paid, and there seems to be some question whether either side desires to have it paid. —*Ry. Gazette.*

Several correspondents ask us to tell how to set eccentrics on an axle before the wheels are placed under an engine. An illustrated article, by H. R. Jones, covered this ground thoroughly and plainly, in our issue of July, 1888. Read that.

The new Wisconsin Central passenger station in Chicago is said to be worth more money than any station building in America. The finest in the world is in India.

The Pittsburgh Locomotive Works are using cast-steel rockers with good success. They are as light and strong as wrought-iron, and very neat in appearance.

The Mason Regulator Company, of Boston, have issued a neat little catalogue and price list of their goods. Their air-pump governors and pressure-reducers have a very large sale in the railroad trade.

Correspondence

"Doc," the Indicator and the Coal Pile.

Editor The Locomotive Engineer:

My friend "Doc," who kicked so vigorously about new fangled ideas in the February number, met me the other day, and in a very mysterious way asked me to tell him what these things meant, at the same time taking out of his time book—what do you suppose?—some indicator cards! He did not wait for me to answer him, but went on telling me that he was pretty old—he is 40—but he was going to school again "You see the traveling engineer rode up and down on my engine pretty often, saw how she worked, and finally told me that as she was about as good an engine as they had, he was going to try some experiments with her. When he held her in to have the holes drilled in her cylinders and a speed recorder put on, I made up my mind that I was going to be bothered to death. Well, he rigged his little chair out on the front end, got all his brass fixings on the steam chest and levers fast to the crosshead and rode out there Another fellow rode on the fireman's seat, watched the steam pressure, where she was hooked up to, what time it was by the speed indicator, and measured the water every time we stopped at a tank, but he never said a word to me the first trip except how-de-do and good-by. I had nine cars and had to pound her for all she was worth to make the time. In the mean time, Ike—that is, the traveling engineer—sat out on the front end making the marks on these papers, and every time he threw up his hand for a signal the fellow in the cab made a lot of entries in his book That lasted for one round trip, when he took all his fixings off the front end and was gone for a couple of days. When he came back he had the eccentrics all set over—she was as square as a die before—and divided up the clearance at the ends of the cylinder so it was even, fixed her up and gave her another trial. This time the other fellow set up in front and he sat in the cab. I had to work her just so, to suit him. I had the local passenger, only five cars, so I made out to hold the time and got in on the tick When we got turned around he had her put on the fast line to go right back, though it was not my turn She had ten cars, most of them delegates to some convention, and they had a guaranteed time to get in on. You can bet the old girl had to do her best, but we made it all right The next night he came over to my house and showed me these cards that I just gave you. He tried to explain the way it worked to me, but Lord Harry, I could not make head nor tail to it. He asked me how much less coal I burnt after the valves were set than before? I told him he ought to know, as he had it all weighed at both ends of the road. Says he, 'How much less water?' Says I, 'About the same; we stopped at the same tanks.' 'Yes,' he says, 'that is a fact, but your tank was not as near empty.' I did not say anything about that, so he said he was going to keep a close record of the coal for the next month and for me to give as good a showing as I could and figure as close on coal as if it was worth a dollar a ton to me. I run her as fine as I could for that month.

To-day I was up in the 'old man's' office to see how she made out. I took on 13 tons less coal this month than last, and used steam heaters more The 'old man' looked solemn enough when I first walked into the office, but he let a little chuckle out of him when he said, 'How was it, Doc, did putting the indicator on your engine save all that coal or did you do it?' Says he, 'That much of a saving on every engine would amount to quite a sum and the company needs it bad enough to buy some more engines' He gave me all the cards to look over and study up and come back when I wanted to ask any questions about them. I won't get around there very soon, you bet. Ike will get a chance to post some one up pretty soon; he has got all the books on the subject he can get hold of I used to think the rule book and daily papers was reading enough for me, but these scientific things have got to be learned." Well, Mr Editor, I looked the cards over, some of them were good, some were not, explained them the best I could, told Doc to subscribe for THE LOCOMOTIVE ENGINEER right off and get all the back numbers. When he reads this and the February number I will have to look out for trouble.

It may be that setting the valves helped Doc's engine, although she did beat square before If she exhausted square that was no sign that she took live steam and cut off at the most economical point. But it is probable that, now he is interested in saving the coal pile, he will beat his old record and make just as good time. Some men get credit for saving coal that never make up any time and always get to the meeting point last, so as to let the other fellow take the siding. But it is a fact that less coal is burned per ton hauled than five years ago on a majority of roads Larger boilers and more heating surface for the same sized cylinder have had much to do with it, but better machinery and more intelligent use of it will make still greater savings. The enginemen are alive to the necessity, and are getting there.

C. B. CONGER.

Lansing, Mich.

Some Nuts to Crack.

Editor The Locomotive Engineer.

In an experience dating back into the other half of this century I have stumbled upon some problems on the road, and will briefly state one or two "circumstances" for the boys to think about and answer

Question 1.—A freight engine on starting her train on a curve broke her back driving axle close to the hub on both sides of the engine, allowing the axle and boxes to drop down on the binders; the wheels both remained in their natural position. By virtue of the writer's position at that end of the road it became his duty to put the engine in a condition to run back to the division shop, 157 miles. She was a 15x22 Roger eight-wheeler, with the forward wheels well ahead She made the run in twelve hours without any trouble, except to warm up a little. The question is, how would the readers of THE LOCOMOTIVE ENGINEER block up so as not to strain the frames or springs?

Question 2—Was out with a work train, had five cars of cinders; shut off for a bridge. The closing of the throttle was followed by the engine taking steam and slipping at a tremendous rate, sending the fire in all directions. As it was dark, I concluded at once that the dry pipe had collapsed. I put on the air and held the train—could not get the lever up—while the fireman knocked out the fire. The racket stopped just as suddenly as it began, and with fifty pounds of steam and some water. I put on injector and filled up boiler as long as steam lasted, sent word to man following to push me into side track close by. If she collapsed dry pipe why did she stop showing steam and water? Or what was the trouble?

Question 3.—Was running a Norris 16x24, had seven cars and was killing time; road level. Heard a strange noise on right side, stopped and examined everything carefully, eccentrics all right, all keys, crossheads and cylinder head all right; told fireman to give her steam, when there was a roar and stream of fire out of the stack, engine would not move. Disconnected right side; put valve at half stroke and tried again, with same result—steam blowing through. Got the train following to tow me in, being under the impression that the right valve was broken, allowing steam to blow through the exhaust What was the trouble?

Corry, Pa. W DE SANNO.

Pay of English Engineers and Firemen.

Editor The Locomotive Engineer:

I have taken your valuable paper for more than a year, and have several times been on the point of writing you on one or more of the various topics discussed in it from time to time.

Have just read that "The engineers and firemen on the Great Western Railway in England earn 4½c. a mile," as high, you say, as the average Eastern roads of this country. This, sir, is a mistake, as, if such were the case, your humble servant would not have left that road, with its double track and block system, for an American single track with no block system.

I worked on that road for more than ten years, four of which were spent in roundhouse, and more than six firing, and having on one occasion conducted the correspondence for the firemen of that road, during an agitation to "lessen the work of firemen before leaving roundhouse," I ought to know a little about the state of things there.

We were paid an hour before leaving time, but as we had to leave the roundhouse thirty minutes before train time, to get water, and at some stations get our engines coaled, as well as help to make up train, we had only thirty minutes in which to get engine ready.

Fireman had first to unlock tool-boxes, sweep up deck, then had to fill sand-boxes (two ahead and two behind), next pack the stuffing-boxes, of which there were six, the valve stems being extended through front of steam chest; and last, but not least, had to clean inside cab and head lamps (two).

Well, sir, we wanted the cleaning taken off the firemen, and pointed out that the work could not be done in the allotted time, but somehow the officials could not take our view of it.

But I am digressing; I started to give you the scale of wages paid on that road, which is as follows:

Switch engine firemen,	3s 0d per day.	
Road eng. firemen, 3d class,	3s 6d per day	1st year
" " " " "	3s 9d " "	2d "
" " " 2d "	4s 0d " "	" "
" " " 1st "	4s 3d " "	1st "
" " " " "	4s 6d " "	2d "
Hostlers,	5s 0d per day.	
Engineers, 3d class,	5s 6d per day	1st year
" " "	6s 0d " "	2d "
" " "	6s 6d " "	3d "
" 2d "	7s 0d " "	" "
" 1st "	7s 6d " "	" "

Hostlers and switch engineers are paid the same rates, 5s 0d. Twelve hours to constitute a day's work on switch engines. The trains were classified as follows

1st class, all passenger trains.

2d class, through main line freight trains.

3d class, local freight trains. Ten hours a day to be paid for all time worked.

Sunday work to be paid for at the rate of eight hours a day, to apply to trains worked in and out on Sunday.

Promotions to be made as vacancies occur.

Firemen or switch engineers employed temporarily as road engineers to receive 6d (12 cents) a day extra.

A premium of £10 ($48) to be given each engineer at the end of the first year at 7s 0d per day and annually afterwards.

The premium was supposed to be given for economy in oil, fuel, etc., and general good conduct, but the man who stood highest on the consumption list seldom got his premium.

The schedule time of freight trains varied from eight to fourteen hours. I have fired main line coal trains 107 miles, and made the bare 4s 0d (96 cents) a day, and also a through coal train running 163 miles for a day's work for the sum of 6s 0d ($1 44), schedule time from 5.40 P. M. to 8.05 A. M.

On the English roads the fireman has to make all the stops with the hand brake, and the help of caboose brake, as on through freight trains they have no brakemen and only one on local runs.

A great many freight engines are now equipped with steam brakes, which makes it easier on the fireman in making stops

With the system of classification in vogue on this road, and also promotion according to seniority, men have to move their families two or three hundred miles for the handsome advance in wages of 6d (12 cents) a day, the names of the engineers and firemen of the whole system being on the books at Swindon, and whenever a vacancy occurs they take the man whose name comes first, and send him to wherever the vacancy is.

I have known engineers who have been running as third class for six and seven years before being promoted to second, and in the case of firemen I was, after firing five years, the youngest of about a dozen second class firemen.

I left that road in the spring of '88, but from letters received up to a few months ago I know that the same state of things exists yet.

Thanking you in advance for inserting this in your next issue, I remain, sir, CURNRO.

Louisville, Ky.

[Some of our New England roads pay no better wages than those mentioned by our correspondent. The item was written after reading an address in an English paper from the chairman of the road to the employes, in which he cited the new rate of wages paid to drivers and stokers as being double the amount paid in 1867. Our correspondent will find a great deal of difference in the wages paid for the same work in New England and Kentucky.]

Pull of the Reverse Lever—Dry Pipe Lubricators and the Back Action Slip.

Editor The Locomotive Engineer:

In regard to connecting lubricator to dry pipe, engines are arranged that way and give good results. Still one cylinder would get all the oil if the ball joint ring on one side was set up too high, or if the T bend was tipped a little to one side, or if, from some bad adjustment of the core when it was cast, the oil would naturally run to one side, one cylinder would not get any oil when the engine was shut off. Engineers using this device tell me that the cylinder with the tightest packing gets all the oil when shut off, as it draws from the other side. As to the difficulty of keeping oil out of the boiler when the engine is reversed, that is the case when oil pipes connect with the steam chest. When the old gridiron slide valve throttles were used, it was usual to oil them frequently b reversing the engine immediately after giving a dose of oil to the cylinders.

W D S., on page 187, thinks the reverse lever jerks because "the link wants to slip *up* the link block." The angle at which the link stands, in relation to the line of motion of the bottom end of rock shaft arm which carries the link block, tends to slide the link down and the block up. On both the forward and back strokes of the valve—in forward gear—the link is at its greatest angle about the middle of the stroke of the piston. When the link leans towards the eccentric, the eccentric rod is pushing, which forces the link down; as it nears the perpendicular position the motion from the back up eccentric tends to keep it at an angle till nearly the end of the travel, when the back up eccentric pulls over the bottom of the link and places it in an angle in the other direction or towards the cylinder, and the pull of the go-ahead rod forces it down again.

Once in the revolution the links are both perpendicular, at that point there is very little pull on the lever, the difference in the pull at that point and where both sides are pulling makes a jerk. Both links are at an angle when the lever hunts for the bottom notch. The eccentrics give a *steady* pull, as can be seen when the engine is towed with valve rods disconnected or when they get a little dry.

It is a fact that a balanced valve *does* make a difference in the pull on the lever when shut off with the valve at full travel. An engineer soon sees it when he has a balanced valve put in in place of a plain valve. The compression and outside pressure may have something to do with it. Give her a little steam, just enough to shut the relief valves, and see if it won't stop part of the jarring our North Carolina friend complains of on page 167.

Master Mechanic John Shields can give some pointers about copper fire-boxes; he is still using them, from choice I understand.

Do not some of the engineers whose engines "slip the wrong way" when running down hill shut off, get the matter mixed up with the jarring caused by valve motion? C. B. CONGER.

Lansing, Mich.

Electricity on a Locomotive.

Editor The Locomotive Engineer:

In reply to Mr Wallace's inquiry in your October edition as to cause of electricity generated at safety valve during the blowing-off process, I would say that the storage of the fluid in the metal of the dome and contents was doubtless effected in one or both of two ways

First. It is a well-established fact in electrical science that when certain metals are subjected to highly-varying temperatures, an electrical current will be generated when such metals are connected, and will continue to flow between them so long as the differential temperature is maintained. Copper and iron compose one pair of metals which produce the effect described. In the case under consideration it is, therefore, reasonable to conclude that the brass work of the dome, or of those parts immediately within its upper portion, may have been heated to a high degree by the escaping steam, while the iron work at a little distance from the dome, and in contact with such brass work, would remain at a much lower temperature than the brass attained, the result being that, according to the above-mentioned process, a current would be established between the overheated brass and the cool iron. A wrench applied to any portion of the "pop," under such conditions, would divert the current, and Mr. Wallace's feet or body, resting on the cab roof, would furnish a sufficient ground connection to effect a discharge of the accumulated fluid, although that it should be present in sufficient quantity to produce such a severe and startling result as that he mentions, is to be wondered at. Many attempts have been made by prominent electricians to utilize this property of certain airs of metals, and such men as Siemens and Jablochkoff have taken out patents on certain methods of producing a current in this way, but the results have so far been unsatisfactory, for several reasons. It is said that Mr. Edison is at present giving much attention to this idea, and hopes to ultimately reduce it to a practical basis.

A second cause of the phenomenon noticed by Mr. Wallace may be looked for in the friction due to the passage of escaping steam over the edge of escape port, or other similar projecting metal edges. This friction might produce a storage of electricity in the surrounding metal by a process similar to that which takes place in charging a Leyden jar, although, as in the previous instance, the quantity thus generated could scarcely be expected to be sufficient to produce the marked effect described. C. H W

New York City.

An Old-timer Satisfied with the Present.

Editor The Locomotive Engineer:

Enclosed find one dollar for another year's subscription to your very valuable paper. I, like Brother Alexander, had a boy promoted. He has passed a satisfactory examination before that august Board of License Commissioners of Alabama, and, like Brother John A., I feel proud of him; for be it known that a parent who raises and puts a son on an engine has accomplished something for the good of his fellow man

A word or two about the opportunities the youngsters have in these days compared to what us old-timers had.

In 1852, when I first commenced crossing hard beech blocks in an old Harkness ten-wheeler between Columbus and Cincinnati it was grief, sure enough; seventeen cords of hard wood in 120 miles, you will no doubt agree, was a good day's work, but that was not all—at the end of the trip, with a long pair of tongs we drew what fire remained in the box, then, to give us an appetite for our meals, we sparked a balloon stack. How would some of the lads like to try it now? The stack was balloon-shaped, with a straight inside pipe; this pipe was surmounted by a cone somewhat larger than the pipe. The cone caught the sparks and deposited them in the bottom of the stack, on which was a small pipe with a cap over it. To remove the sparks at end of trip we had a pipe that fitted over the capped pipe on stack, a hook and a club—made by putting a turned stick through a piece of tank hose. With the hook we raked out the sparks, and when they stuck fast we pounded them down with the stuffed club. Let old-timers prate about the good times they used to have, but I will take mine as they are at present.

The Grasshopper C W Crawford speaks of was switching on the piers previous to the time spoken of. Some time in the early '50s she was wrecked on the Cleveland & Pittsburgh road by cross ties being placed in a cattle-guard; her engineer was killed; I think his name was Watson.

The slipping of drivers when engine is shut off is no new thing. I run a five-foot wheel Baldwin, the "Alentanga," cylinders 13x26, that had it bad (This was in '56 or '57.) If the rail was a bit damp, and her nose the least bit down grade, unless I gave her a little grit she would make the fire fly out of the ash-pan; shortening the stroke cured her.

East Rome, Ga. WHEEL OF FORTUNE.

About Pinkerton Men.

Editor The Locomotive Engineer:

It seems to me that the squib on the "Curse" business is a little out of place in a paper of this character.

Pinkerton men may be, and probably many of them are, toughs from Toughtown, but are they not amenable to law, the same as any police, or the constables of England, against whom John Burns says not a word?

England has a standing army that can be called on at a moment's notice to protect property. we have none, and so, when train-wrecking strikers ply their trade, men are hired to prevent their hellish work.

But that is not the point. When a man strikes he leaves his job because he is not satisfied with the conditions, and when he leaves he has no right whatever on the firm's or company's ground. He has left them, and they can insist that he stay "left," and not trespass. Now, if these strikers, wherever they may be, do not intend to trespass on the railroad, either to block trains or to intimidate workers, what need they care if there is a Pinkerton man on every tie? They have no right there, and he has. The moment he breaks any law he is liable to arrest, the same as one of the strikers. That arrest and conviction does not follow is a fault of the town in which the trouble occurs.

"The people have a right to resist the sword by the sword." Very true; and have not the Pinkerton "toughs" a right to do likewise? The first attack, in nine cases out of ten, is made by strikers or their sympathizers, and if the "toughs" do kill a man once in a while, is it any worse than derailing trains and imperiling the lives of hundreds? The strikers use the sword first, and then cry "coward" because the "toughs'" swords are the sharpest.

I have no love for strikes nor any of their attending evils—Pinkerton toughs included—nor do I believe the fault is always one-sided; but as long as strikers will persist in destroying property, in trespassing where they have no right, in order to block trains or intimidate men at work, so long must the railroads or firms in question take steps for the protection of their property. If the government will afford it, so much the better. In the meantime, Pinkerton toughs are in demand, and their lawlessness, even if as bad as painted, is better than the derailment of trains and the burning of bridges

The suggestions made in the article referred to are hardly in keeping with the law-abiding LOCOMOTIVE ENGINEER. C. B. RICH

Philadelphia, Pa.

[Our correspondent mistakes the case entirely. The police of this country and the constables of England are authorized officers of the governments. Pinkertons are a mob. No one objects to the protection of property by the police. We object because they do not protect it from one mob, and do turn it over to another mob.

If the civil authorities are too weak, our militia can be put afoot just as quick as England's standing army.

In nine cases out of ten crowds collect where Pinkerton's men are stationed—to see what they will do. Every one knows that they are usurping the authority of the police, and they are disliked. Some boy jeers at them, another throws a stone—and the Pinks shoot into the crowd, generally hitting a woman or an old man—they seldom hit a striker.

Our correspondent says if Pinkertons do wrong they are amenable to the law and can be punished. That is just what we are kicking about—they should be arrested and fined for appearing in any community armed. They are a menace to the safety and peace of the people. There is little doubt that they do as much train-wrecking as the strikers—they want to stay in a soft job as long as possible. Train-wrecking is murder, and guilty parties should be punished—no matter who they are.

We do not object to Pinkerton's men because they are opposed to the strikers—let the strikers take care of themselves—but because they are a menace to the public, and have killed more people in strike times than all the train-wrecking ever did—innocent people, too.]

Getting Patents.

Editor The Locomotive Engineer :

You say in the September paper that the patent office should not issue such patents as the V-shaped slide valve. I agree with you, but would call your attention to the fact that fully three-fourths of the patents issued are no better.

The trouble is in the system, and in the existence of patent lawyers; these are the fellows who swell every young inventor's (?) head, and wheedle his money out of him.

When a man gets a patent, his trouble is only commencing—he has to defend it in the courts, and if he is poor he has no chance at all.

Montgomery got bounced from the patent office because he proposed to give every applicant a patent for a fee of one dollar, and then let them fight out their priority of claims, etc., in the courts—as they have to do anyway. The patent lawyers got his scalp in no time—the plan he proposed would kill their trade.

The beneficiaries of any form of misgovernment or mismanagement can always be depended upon to fight reforms or changes, and a reformer's lot is always an unhappy one, if he is the pioneer.

After the battle of Chattanooga, General Rosencrans made an estimate of the amount of ammunition used, and the killed and wounded on the enemy's side, and reported that it took sixteen pounds of lead to kill one Confederate; he said it was not the lack of numbers or of bravery that prolonged the war, but *bad shooting*—the very thing that received the least attention—but this was a criticism on the "powers that were," and the reforming general was soon after removed.

It seems to me that if witnesses were required to swear that they had seen the invention in actual use and report, independent of the lawyers and the inventor, that there would not be so many patents by half—after seeing his invention in practical form many an inventor has wished that he had never patented it. HUGH CRUMLISH

Buffalo, N. Y.

Experience with Broken Side Rods.

Editor The Locomotive Engineer :

It is claimed by some mechanical engineers that there is no such thing as gradual crystallization of iron, when properly used, although constantly in vibration.

I would like to ask if broken side rods are ever examined minutely at the point of fracture, and comparison made with that part of the rod that receives the cold bend, by end thrust on a tie or frog?

Have seen so many broken side rods that showed a clean, sharp, square break, that it proves to me that constant vibration does crystallize iron. Enclosed find sketch of broken side rod. The writer was taking an engine to the shop, running light (about twenty miles an hour), when the left side rod snapped square off about the middle of the rod; the forward part struck a tie and doubled up in the form shown, flew around and jammed against the main rod, the rear section took the usual course—through the bottom of the cab. The fracture was clean, bright and sparkling.

I would like to say a word right here to young runners, to wit: Never reverse your engine when she breaks a side rod, but stop as quick as you can with the brake, allowing your engine to roll ahead. There is a possible chance of saving the other rod and pins, when in reversing you are likely to throw the engine out of tram and wreck both sides; it was by adopting this course that I saved the right side of this engine.

I make the assertion that bad quartering will not break side rods, it may pull off a pin or break a strap, but with a solid-end rod the pin is most likely to go.

Mr Camel advises the filing out of the brasses to allow for variation in length. If rods are bored out the distance of the driving axles between centers, and $\frac{1}{16}$ larger than the pin, they will run ninety-nine times out of a hundred, and it is a waste of time to adjust a rod with the tram, and then tram the pins; if it is a strap rod, couple up one end and turn the other pin around until it comes up against the brass in other end of the rod. Mr. Camel's advice is all right, but impracticable.

Ross Winans was about the first to use solid-end rods; have heard it said that his wife suggested the idea, railroad companies could have followed the idea up with advantage to themselves. Long live the solid-end rod

Corry, Pa W DE SANNO

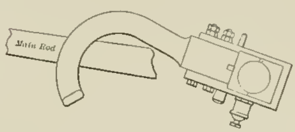
[Our correspondent seems to think it possible to crystallize a piece of iron, through constant vibration, all in one spot, the cold bending the rods endure after the break seems to show pretty good material. We are inclined to think the rods are broken by a tensile strain caused by being too short. Any strain between the pins is transmitted through the rod, and bad quartering will pull off a pin or break a strap only when the pin or strap is weaker than the rod]

How to Twist an Axle.

Editor The Locomotive Engineer.

In reply to Mr Frank Phelps, Ft. Hancock, Texas, I will say that I don't know how both back and forward axles could get twisted alike, nor did I say that both axles on 121 were twisted, I will say, however, that the forward axle was twisted badly, and both were worn badly enough to throw away

I think you can twist an axle very easy by giving your engine sand when she is slipping, especially



when one sand pipe is stopped up; for instance, suppose your right-hand sand pipe is stopped up, your engine gets to slipping, and you give her sand on left side just as she gets on her center. She would be on her quarter on the right side, where she would get, not only the momentum of the wheel, but force of steam also (providing you are using steam when you give her sand, which I think is a very unwise thing to do), don't you think that would twist an axle?

Syracuse, N. Y. W F RELYEA.

In Place of "Hog."

Editor The Locomotive Engineer:

I have noticed in your paper the name "Hog" given to some engines on the P R. R. I can't see any resemblance to the hog, and I thought that as locomotives are generally called "The Iron Horse," why not call them the "Perchon." I believe that is the name given to the largest horse in this country. I will admit that under the wheel covers of these engines there is a place that looks very much like a hog-pen, and perhaps they deserve the name. EDWARD GIBSON

Wilmington, N C.

Last Word on Squaring Valves

Editor The Locomotive Engineer:

When a poor devil gets into a dispute on any mechanical point it is devilish hard to quit, especially while you have personal charge of a lot of old scrap heaps during cotton season in Texas. Our friend De Sanno seems to differ with me on setting a valve and squaring one. I call squaring one getting your valve yoke to fit your valve so that it will be square at both ends of steam port, getting your links plumb and hangers the same, and proper length, also arms on tumbling shaft proper length, and reach rod the proper length. Now I do not claim to do all this in ten minutes, but I do claim that a man should take his trams, get his centers and run his valves over both motions, forward and back, in ten minutes, and tell his machinists what to do if eccentric blades are to be shortened or lengthened and eccentrics moved.

He should be able to tell all this in ten minutes. Let his machinist move eccentric blades to their proper length, and if eccentrics are to be moved, let your man get his set-screws loose. Always let your man take off lead before he puts it on, and see that he does not get his eccentrics too close together or too far apart. Whatever lead you want your engine to have he gauges with the thickness of sheet-iron; then let your valve gauge drop in all four center punch marks from all four quarters of driving wheels, and then you can bet on her exhausting square and doing all the work she is capable of doing.

Now, dear Editor, I hope you will excuse me, as this will be my last letter until next spring. I am satisfied that some readers of your valuable paper will be glad to see me out of the ring. Do not forget to keep sending me the paper, because I like to hear from the boys. E. A. CAMPBELL.

Houston, Tex. Supt. M P. & Machinery.

[Bro Campbell's ten-minute rule for squaring valves works something on the plan adopted at Altoona, Pa., for building a complete locomotive in ten hours—had the parts all made and half assembled before they commenced.

If the valve stems are marked with the port marks, and a standard tram used, it might be possible for a mechanic to see if the valves were out in ten minutes, and perhaps tell where the trouble was; but as for squaring them up, as should be done, most master mechanics would consider that ten times ten minutes would be fast work, and forty times ten pretty good if there was much to do, or it was necessary to take all the measurements.]

An Indian Brake Trial.

On the Eastern Bengal State Railways of India there has been a brake trial in progress for nearly a year, and Mr. A W Rendell, the locomotive superintendent, has just issued his report on the same.

Among other data sought, Mr Rendell compared the fuel used by the two brakes with rather surprising results. Finding that the engine equipped with the Westinghouse brake burned considerably less fuel than the one fitted with automatic vacuum, he ran them some time without brakes and found that the Westinghouse engine was in better condition and using 4.8 per cent. less fuel than the other engine, so in his report he deducts this amount from the air-brake engine's showing and still shows the following results

	Westinghouse lb.	Vacuum. lb.
Coal per train-mile . . .	31.87	36 08
" 1,000 ton-miles. . . .	237 98	259.42
Water per pound of coal. . .	6.45	6.31
" train-mile	205.47	227.73
" 1,000 ton-miles. .	1533.83	1637.38

A saving of about 10 per cent. in favor of the Westinghouse brake

It is very well known that a jet of steam is a considerable drain on a boiler when hard pressed, and trouble has been had in England and India from the engineers shutting off the vacuum-producing jet to save steam, on some roads they have introduced an air pump—coupled to the crosshead—to maintain the vacuum. This, however, is no fault of the brake, as engineers often shut off the Westinghouse pump for the same reason; still where it uses so little steam there is not the temptation to economize in this way.

There is great agitation in England on the brake question, over the alleged fault of the automatic vacuum in freezing up; this brake has been very popular, but in the present discussion and trial Westinghouse seems to be taking first money.

The prosecution of the alleged N Y Central train wreckers has flattened out; there was but one man indicted by the grand jury, and no case was shown against him, and he was discharged by Justice Gragan, Oct. 11. The railroad should learn from the experience of its men, grievance committees are dismissed if no grievance is found by them, and the Central will probably find that the men (God save the mark!) employed to find train wreckers knew where they were to be had.

LOCOMOTIVE ENGINEER.
DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

☞ *Correspondents should give name and address in all cases, though not necessarily for publication.*

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CONTENTS

Making Bricks Without Straw.

You do not have to go very far or hunt very long now-a days to find a master mechanic or machine shop foreman kicking about the quality of mechanics, and bewailing the fact that "machinists ain't what they used to be"

Motive power officials are themselves wholly at fault for the lack of good railroad mechanics and for the hordes of useless ones. This is a broad statement, but it is true, nevertheless. A look around a railroad shop is enough to convince any one.

Good mechanics are in constant demand now, first-class machinists are worth $3.50 and blacksmiths $4 per day—yet there is no supply for the demand. Botch workmen are plenty, and dear at any price.

In order to make first-class mechanics it is necessary to have, as seed, apprentices of intelligence, with common school educations, a taste for mechanics and an ambition to become proficient in the business. With this kind of material to begin with, time, opportunity and experience will produce a first-class mechanic—just as a little attention in the right line produces a chick from a good egg; time, attention, opportunity nor anything else ever made anything of a bad egg—except a worse egg.

Show us a railroad shop where they try to select good material for apprentices; it is not done in one case in a hundred. Let the average youth, say 18 years of age, go to an M. M. or shop foreman, seeking an opening for a chance to learn the machinist or blacksmith trade, or to get a job firing, and what encouragement does he get?

In the first place he is too old, says his judge, don't want no schoolboys anyway, and, if the applicant has pride enough about his personal appearance to wear a clean collar he is put down as a "dude."

The very youths who would make bright and useful mechanics are shut out from a field of usefulness that they would honor and adorn—for what?

To give room for boys who go into the shops for the bare wages in sight or because they are forced there by their fathers, who are in the service some place or have some influence with "the powers that be."

Mickey Doyle is the oldest wiper on the road, hasn't missed a day for nine years, he wants to get his boy Dennis doing something to help support him, as he won't go to school, so he makes application early and the boy is worked in as helper, serves three years as an apprentice—just as he would serve three years as a prisoner—and turns out as a machinist; he don't go to work as a jour. in the shop. No, the foreman can't put on any full pay men, just then, so he goes off, a finished mechanic, and the master mechanic or foreman is glad to be rid of him

If possible, Dennis is got on the road firing—pays more on the start—he is given a job cleaning ashpans or wiping, the foreman mentally declaring that he knows enough for that, and that's about all; but a rush occurs, and the first available man is pressed into the service, so Dennis gets to be smoke shoveler, and, as the agreement with the men says seniority is the proper qualification for promotion, Dennis gets an engine in his turn. One more plug engineer added to the list of bad ones, and another young man, who would have made a good one, forced to drive horse car, tend bar, or go into politics.

The railroad officers are complaining about the quality of engineers and mechanics, and are themselves making poor ones all the time It would take some work, a little thought, and a departure from precedent, to choose apprentices for all positions upon the merits of each case, to give intelligence, natural aptitude and decency preference over cousinship, friendship, politics, religion or boodle.

Anything will do for a wiper or a helper, and after the wiper or helper has been pushed up to promotion, his own maker will complain of the bricks without straw on hand, and blame the brick—instead of blaming the maker.

If a boy wants to drive a canal boat, and his father wants him to be a machinist, and forces him into a shop, the parent stands just as much show of making a good mechanic of his boy as he would of making his daughter happy by marrying her to the man of *his* choice, and murdering the man of *her* choice.

When those who have the making of mechanics will seek to improve the quality by selecting good timber, and keeping up a constant inspection for "culls," instead of employing in subordinate positions those who are forced upon him, or who are the least trouble to get, we will have a better crop of machinists and engineers—and not till then.

We have no patience with that class of pessimists who are constantly declaring that good, bright boys don't want to learn trades. Once announce that you will put to work only intelligent young men who have gone through the public schools, and who themselves desire to learn the trade, and who will, after six months' trial, satisfy you of their adaptability, and desire to become mechanics, and that they will be promoted on merit, and you will be overrun with applications, and can pick out the future mechanics of your road from the cream of the land.

There is a crying need for good mechanics, the brightest boys in the land are anxious to become such, and there is room for them. Why don't they get the chance? Is it because of the inability of American shop foremen to tell good material from bad? Is it because they want poor mechanics, so that they can be whales among toads? Is it because they are apathetic, and do things the easiest way? Or, is it because they are themselves the wrong men in the wrong places, promoted on account of the date they hired to the road, instead of what they know about their business or the selection and management of men?

The New York Railroad Club.

The New York Railroad Club has been brought to life again and has started in to hold meetings for the winter. There has been a surprising lack of interest taken in this club for the past year or two. New York city ought to have the best railroad club in the country—it has been about the poorest. In looking around for the cause it does not seem very hard to locate—the practical railroad men have lost interest. Why? Because the benefits derived have not been enough to pay for time and trouble to get to meetings. The club is composed of railroad men and supply dealers in the railroad trade, the latter class contributing most of the expense money. Perhaps the efforts to have things too nice have used up the surplus energies of the club. They have recently rented a room and hired a janitor, this room is in the Gilsey House, is accessible, and all that, is to be open to club members and their guests from 9 A. M till 12 P. M. every day. This costs money, and few railroad men will congregate there except on meeting night Without presuming to criticise, we should say that the amount expended in keeping open house would hire able speakers, or set up a good supper every meeting night, and a good speaker on a live subject or a good supper for live subjects will call in the railroaders every time A meeting of supply men and newspaper fiends, calling themselves a railroad club, is like an oyster supper without oysters.

If the N. Y Railroad Club will hire a good meeting hall one night in the month, pay a secretary enough so that an able man can afford to devote some time to its business, and set up a fair supper and a short paper on a current topic, providing a seat for each member and one friend, we guarantee the regular display of the "Standing room only" card. And they won't be all supply and newspaper men, either.

Books Received.

THE WESTINGHOUSE AUTOMATIC BRAKE CATALOGUE OF 1890 Issued by the company, Pittsburgh, Pa

For free distribution to those having in charge the repairs and maintenance of brakes. It is not a descriptive catalogue, and therefore the cuts are made to specially show parts in a way best suited to the purpose. Every part of the complete automatic brake of all kinds used are illustrated, numbered and named, and the prices given. The illustrations are new, and the information all that can be desired by master mechanics and car builders having the maintenance of brakes in charge, the size is 9x12, the same as former catalogues

SOUVENIR OF THE TWENTY-SEVENTH INTERNATIONAL CONVENTION OF THE BROTHERHOOD OF LOCOMOTIVE ENGINEERS

This is the usual bound volume gotten out every year for advertising purposes to meet the expenses of the convention. It contains an historical sketch of the city of Pittsburgh (where the convention was held), and biographical sketches with portraits of the grand officers and the committee of arrangements. We believe the book is not sold.

TRIPLE-EXPANSION ENGINES AND ENGINE TRIALS. By Prof. O. Reynolds, LL.D., F. R. S. M. Inst., C. E., &c. Edited by P. E. Idel. D. Van Nostrand Co., publishers, New York. Price, 50 cents.

This little work describes a series of tests made with triple-expansion engines under many different conditions, with and without steam jackets, condensers, etc. The work is chiefly valuable in showing how such experiments should be carried on, describing every detail of the apparatus, and giving the results with triple-expansion engines with various pressures and piston speeds. The book is gotten up in neat shape, bound in green boards in Van Nostrand's uniform size known as the "Science Series," about 4x6 inches in size.

HANDY LISTS OF TECHNICAL LITERATURE, PART III. Heise & Haferkorn, publishers, Milwaukee, Wis. Price, paper, $2.50; cloth, $2.75. Key, 25 cents extra.

This work is a 200-page catalogue of all standard work on civil and mechanical engineering. The price seems at first to be very high for such a list, but for a busy student the list is invaluable. It gives a brief summary of the contents of the work, the year in which it was issued, the author, the price, and a list of those who sell it, and the address of the publisher. It tells at a glance all that is extant on a subject, and saves hunting absently over libraries.

HAND-BOOK OF CALCULATIONS FOR ENGINEERS, FIREMEN AND MACHINISTS. By N. Hawkins, M. E. Theo. Audel & Co., publishers, 91 Liberty St., New York City.

This book is intended for both reference and instruction in the first principles of the mathematics of steam engineering. The opening parts teach first, how to write and read figures, and from this primer like commencement, the work proceeds to give the elements of arithmetic, mensuration, geometry, algebra, etc., all illustrated with examples of calculations relating to the every-day problems of the engineer.

Beginning with natural or mechanical philosophy, in which the primary powers are mentioned and briefly described, the lever, wheel and axle, the pulley and inclined plane are illustrated with examples and description. Next follows as general subjects thermo-dynamics, or heat-power; *i. e.*, the power which is produced by burning of fuel; horse-power, with copious rules for its calculating, both of engines and boilers and of every variety, pumps, with many practical "points" to their management and calculations; steam, description and figures relating to this main subject; injectors; gravity; strength of materials, with useful tables; the steam boiler; the safety valve, with many rules for ascertaining the safety limit of pressures, the steam engine, with illustrations and calculations and description of varieties; engine counters; illuminating gas, and how to read the gas meter; table of melting points of solids; electricity, how to measure and figure it, with many useful "points" in its management; table of conductors and insulators of electricity; chimneys; transmission of power by belting and pulleys; the indicator, with illustrations and rules for figuring the diagrams; business points for engineers, and index combined with useful definitions.

The work is published in ten parts, neatly bound in green paper covers, and also the whole ten parts in cloth with stiff covers. The price in parts is 25c. each; in book form, $2.50.

THE WESTINGHOUSE AIR-BRAKE INSTRUCTION BOOK. Issued by the company at Pittsburgh, Pa. Price not stated.

This work of 70 pages is in pocket form, bound in leather, with a pocket containing cuts of the principal Westinghouse apparatus. The body of the work is a brief instruction lecture on how to handle the quick-action automatic, although it has chapters on the signal, the driver-brake, levers, etc. The cuts used are all new and neat, and the work is complete in the fewest possible words, making it invaluable to locomotive engineers and firemen. The best chapter in the work is called "Don't," and is reproduced in another place in this issue. No locomotive engineman who has to do with air-brakes can afford to do without it.

ASKED & ANSWERED.

(64) J. G. S., Long Island City, writes:

What is the longest tunnel in the world? *A.* The Croton aqueduct, New York, 32 miles long.

(65) W., Chicago, asks:

When a steam gauge registers less pressure than the boiler carries, is it called light or heavy? *A.* Light.

(66) J. W. P., Senney, O., writes:

I see in the October issue of THE LOCOMOTIVE ENGINEER, where John Alexander states in his letter entitled, "That Hoodoo Model," that valves cannot be divided square at all points of cut-off. Please tell me the reason why. *A.*—He stated that it was impossible to get them *exactly* square *for all points of cut-off forward and back*. This is impossible with the link motion on account of the angularity of the main rod. Practically, the cut-off can be set all right, but not *exact*.

(67) C. W. S., Janesville, Wis., asks:

What is meant by total wheel base, and driving wheel base, and do we not sometimes see the terms rigid wheel base used? If so, please explain. *A.* Total wheel base is the distance from the center of the front to the center of the back wheel, regardless of what they are, trucks or drivers. Driving wheel base is the distance from centers of extreme drivers. Rigid wheel base is the distance apart of the extreme drivers having flanges; thus an eight-wheeler with the front driver tires bald has no rigid wheel base, properly speaking.

(68) S. W., Milwaukee, Wis., asks:

Is lead a benefit to an engine in starting a heavy train or a dead pull? *A.*—There are two sides to the question. All pressure put upon the pin at the dead center only increases the friction and does no work until the pin has got away from the center; in a dead pull, perhaps negative lead, or a lack of lead would be a benefit. The other side is in the economy. We want heat in the cylinder, and the walls heated as soon as possible. Lead would materially help that. Generally speaking, under the conditions named, lead would not be a benefit.

Locomotive Running Repairs.

BY L. C. HITCHCOCK.

The subject of running repairs is so broad, that in writing upon it there can be no assurance given that many new ideas will be advanced, owing to the fact that there are scarcely any repairs to be made on an engine which may not be made in several different ways, any one of which may produce good results.

It is not the intention of the writer to have his articles convey the idea that the ways he describes of doing work are the only correct ways, for it may be proven that in some instances the ways described are not the ways which will produce the best results.

"All men are prone to error," and I do not believe in the "My way is the best and only way" theory, for if there lives any one man who knows it all I have never had the pleasure of meeting him.

There is always a *best* way, and the object of the writer of the articles on running repairs will be to get this best way before the readers of THE LOCOMOTIVE ENGINEER, and whether they get this from reading his articles, or from the criticisms and suggestions from some of his readers, is immaterial if the desired object is gained.

The intention of the writer is to tell the boys in the plainest manner possible of the way different classes of work has been done which has produced the best results, as far as my observation has enabled me to judge. And where there exists a probability that, by doing work in a certain manner, poor results would follow, the desire is to explain to them what these results would be, and why they would be produced, that all may avoid doing work in an improper manner; and should any of the readers of THE LOCOMOTIVE ENGINEER "pick me up," and explain better methods of doing running repairs than those which will be described, I shall thank them, and cheerfully "stand corrected." The writer is selfish enough to hope and expect that he will derive as much, if not more benefit from the corrections and suggestions from his readers than they will receive from reading his articles, though an effort will be made to make them as interesting and instructive as possible.

GRINDING IN BRASS VALVES, COCKS, ETC.

It is a good plan, I think, for roundhouse foremen every morning and noon to personally look over the book in which the engineers report the work to be done on their engines, and to assign to each man under his charge the particular work he is to do. While doing this recently I noticed where an engineer had reported, "Grind in right injector line check," and told a machinist (a new man who had only begun work that morning, and who was awaiting to have his work assigned to him) to take off the cap of line check, and examine the condition of the valve, and also to have the boiler washer lower the water in the boiler to enable him to examine the condition of the boiler check valve, and to note the lift of each. Then I wandered around through the house, apparently not seeing anything in particular, but in reality keeping a close watch of Mr. Machinist. The first thing he did after examining the condition of the check valves, as instructed, was to go to his tool cupboard and take out two cans of emery, a little cotton waste, and a squirt can, and start for the engine. On his way there I met him and asked him what he intended to do with those things. Said he, "Grind in the checks, they need it." Right then was when the lecture began, and he was told that the checks did not require to be ground with the emery and oil he had, he was shown where to get a piece of an old grindstone which had been broken, and was told to powder it up, and sift it through an old red flag which we had for the purpose. Then he was sent to the storeroom for a bar of soap—not cashmere bouquet, but yellow soap. The boys call it "washerwoman's delight," and in an old box lid we mixed the grindstone powder and soap with water into a thick paste.

This for grinding brass surfaces together, when water is used instead of oil, gives the best results of anything we have ever seen used, owing to the fact that the particles of grindstone will not embed themselves into the brass surfaces, as will the particles of emery, causing the surfaces to cut.

Never grind brass cocks, etc., with emery. The proper way to grind a brass cock (if you have the cock off so you can catch it in the vise) is to catch the large end of the plug in the vise, and grind the shell to it, giving it each time about one-half turn, pulling the shell a little away from the plug after each half turn, continue this for six or eight seconds; then remove the shell from the plug, and clean each thoroughly and rub them together dry, rub hard; do not be afraid that they will cut, for they will not, if there has been no substance other than the grindstone powder and soap between them.

When rubbed together dry, the heaviest bearing will be indicated by dark yellow lines. Should these not be universal the entire length of plug and shell, rub clear soap on the dark yellow lines on the plug, and put the paste and water on the other parts and grind again, but only a few turns before cleaning off and examining again. When the bearing is perfect on shell and plug, put a little beeswax and tallow melted together on the plug, and put it into the shell, and you will have a nice, tight, free-working cock.

Before commencing to grind brass surfaces, pains should be taken to get as nice a bearing as possible by the use of a fine file or scraper, using lampblack and oil, or something of that nature, for a marker. Then, while grinding, care should be taken not to bear on too heavily, or grind too long, before separating the surfaces, as this allows the particles of grindstone on each surface to change their positions, and this prevents cutting. Those who will follow these simple directions while grinding brass cocks, etc., will have no cause, I think, to regret having done so. I know of one man at least who believes it to be the correct way, and that is the man who ground the checks; for, said he, "It used to take me longer to get the emery and cuts out than it does now to do the entire job."

While speaking of checks it may not be out of place to suggest here that every time a boiler is washed out the check caps be removed, and pains taken to see that the check valves, and the passages in the check shell are perfectly clean, and that the joints are perfect on the valve and seat, for while boiler is being washed, scale, etc., is liable to be washed over on top of the check valve, and this oftentimes prevents the free working of the injector, and in this case, as in most others, "An ounce of preventive is worth a pound of cure."

The Old Colony disaster has called out orders from many roadmasters and superintendents to invariably place track jacks on the outside of the rail. This order is well enough where a "step" or "hook" jack is used, but don't count where those abominable straddle jacks are found. The safe plan is to use jacks that are entirely below the line of the rails.

The standard fire-door on the B. & O. is the double-sliding door operated by a lever, in common use in Europe; they have no liner, and get hot enough to crack, but are cheaply replaced.

Simple Lessons in Drawing for the Shop.

By Orville H. Reynolds.

THIRTEENTH PAPER.

A drawing of a slide valve and its seat can be made productive of much good, not alone as a work showing skill acquired, but more for the practical ideas which are sure to be developed by a careful study of it, as will be shown later.

Let us take for an example a valve and seat such as is found on a modern 17x24 passenger engine, and draw it to a scale of 3 inches to one foot, as shown in accompanying engravings.

Draw horizontal line *A B*, Fig. 87, to represent the valve seat face. Erect a perpendicular at *C D*, which shall be the center line from which to lay off all horizontal dimensions.

To draw the lines representing ports on the valve seat, lay the scale on line *A B* and mark off equally each side of center line *C D*, one-half the width of exhaust port *E*, either with the pencil or a needle point; the latter is preferable for close work, for the reason that it leaves a fine dot on the paper that cannot be erased or misunderstood.

Drawing pens are often equipped with such a needle point in the end of handle, and is visible only when the pen is unscrewed from the handle; but in the absence of one of this kind the point of divider leg will be of use.

Leaving the scale in the position first taken, prick off distance *F F* on each side exhaust port for bridges, and in like manner *G G* for steam ports; next lay off distance *H H* each side of center line for total width of valve seat.

Through points laid down, erect perpendiculars to line *A B*, making them about two inches long; this forming an outline of valve seat, and a true one, because of the way in which the points were laid off.

It will be seen that there is not the same probability of error when leaving the scale in one position while laying off points each side of a center line, as there is in shifting continuously from one dimension to another; this is a fact that should always be borne in mind.

Taking same center line *C D*, use the scale as before, and lay off the valve in its middle position, or central over the ports, the valve face joining that of the seat on line *A B*.

Laying off first the lines of exhaust edges *I I*, then width of valve yoke fit *K K*, and lastly the width over all, *J J*.

All dimensions in a vertical plane are next laid off, beginning with thickness of valve face; after which lay off height of yoke fit on line *K K*.

The total height of valve having been marked on line *C D* we have three points through which an arc should be drawn by the compasses, the center to be found as in Fig. 40, seventh paper.

From this center describe another arc at a distance below the first, equal to the thickness of metal, or about ⅞ inch.

Lay off a like distance inside of lines *K K*, and draw to intersection of lower arc, then connecting lower end of lines to exhaust edges *I I* by a small arc.

The outline of valve and seat being completed, they should be section lined in the usual way, and dimensions placed as shown.

Fig. 88 is another sectional view of valve and seat taken on line *C D*, Fig. 87. Using the T square, project from Fig. 87 all lines lying in a horizontal plane, beginning at the top of valve. No special instructions are needed in this view other than to lay off from center line *L M* all dimensions without moving the scale as in preceding case; this view represents a section crosswise of cylinder.

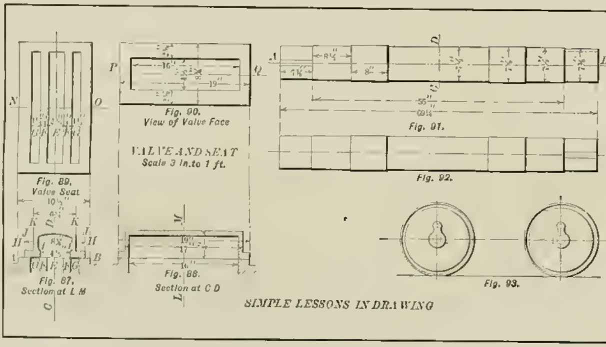
Plan view of seat is shown in Fig. 89; the vertical lines are projected from Fig. 87, and horizontal lines laid off from center line *N O*.

The dimensions are taken from both Figs. 87 and 88. A bottom view of valve is next shown in Fig. 90, the vertical lines being projected from Fig. 88, and horizontal lines laid off from center line *P Q*.

The operation of laying off the valve and seat in the shop, as a preliminary to the machine work, is plainly identical with the drawing of them, hence it can have no terrors for one who has been through the subject on the drawing board.

By drawing Fig. 87 full size, and cutting the valve and seat apart on line *A B*, all the functions of the valve are nicely shown when moving it back and forth over the seat. When the steam edge *J* of valve reaches outer edge of steam port *G*, admission begins; the valve continuing to the end of its travel and returning, steam is cut off when edge *J* again reaches outer edge of steam port *G*, expansion then begins and continues until edge *I* of exhaust cavity reaches inner edge of steam port *G*, when exhaust occurs; when edge *I* of exhaust cavity and inner edge of steam port *G* coincide on return stroke exhaust closes and compression begins.

The extreme travel of valve will show how much line *I* over-travels on the exhaust port *E*, and will also show how far steam edge *J* travels on bridge *F*.



To determine when valve is at end of its travel, measure the horizontal distance between center lines *C D*; thus, if travel is 5 inches, the center line of valve should be moved 2½ inches beyond center line of seat. Another method is to describe a circle whose diameter equals valve travel, taking for a center the intersection of line *J* with valve seat when valve is in its middle position.

When the valve is central over the ports, as represented, the laps are plainly shown; the outside lap is ⅞ inch, and equals the amount that steam edge *J* stands over outer edge of steam port *G*.

The inside lap would be represented by the amount that exhaust edge *I* of valve stood over outer edge of bridge *F*, but in this instance there is no inside lap, the valve being what is known as "line and line," that is, the edges *I* coincide with outer edges of bridges *F*.

It is thus seen how edges *J* control the admission and expansion, and edges *I* govern the opening and closing of exhaust.

Placing the dimensions on the drawing as in examples, see that they scale what they are marked, and in addition to this measure of safety add together all dimensions, and see if they foot up to total distance; if the footing is correct, the figures are right; if not, be sure to find the error; without accuracy in this work the time is worse than wasted.

It will be interesting as well as profitable to the student to sketch as many different designs of valves and seats as possible, obtaining the travel of valve in each instance, so that the subject may be handled same as the one just considered; a diversity of practice will be found which may lead to a desire to know why.

Fig. 91 represents a driving axle which should be drawn by first laying off two center lines *A B* and *C D*. From *C D* lay off all vertical lines, representing shoulders; from *A B* lay off all diameters and draw them to intersection of vertical lines.

The distance between wheel hubs is the important dimension in this example, although all others should be correct as well.

The key seats are next shown at right angles to each other. All dimensions having been marked in their proper places as shown, we have a driving axle as drawn for shop use.

The ever present opportunity for making mistakes is lurking right here in this innocent little axle drawing, as will be made clear.

With the key seats as represented we have what is known as a right-hand crank—that is, the crank on right side leads or is ahead of crank on left side, when engine is running forward.

Fig. 92 shows a left-hand crank when key seats are put in as shown, the usual practice being to cut those in the wheel, so that they are on the center line of pin and axle, in which case each key will represent a crank-pin.

Now, let us suppose that the man who has charge of the "wheel job," or whose duty it is to lay off the key seats, puts the lines for same at right angles to each other, but fails to notice that they are laid off like Fig. 92; then there is trouble after axles are pressed into their wheels if old axle is a right-hand crank and new one left-hand.

The result is shown in Fig. 93, where crank pins on one side are in tram, and opposite side is not. It is apparent that careless work in laying out key seats will lead to disaster, even if they are quartered right.

The Topeka shops of the Santa Fe are turning out twenty-six engines per month, although previous to Mr. Player's administration the output was ten. To G. W. Smith, the division M. M. who has immediate charge of these shops, much credit for the increased output is due, and his ability as a pusher is so well recognized and appreciated that he has had other offers, which the Santa Fe has "seen," and gone one better to retain his services. Mr. Smith's forte is rushing out work, and, it is timely to add, good work which stays out.

"Abe" Cherry and "Bill" Harrison, after nearly fifty years of service as engineers on the N. Y. Central road, have gone over to the great majority. These two men did nearly a hundred years of work upon a locomotive. Just think of the experience, the grief endured, and the wealth produced by this pair of workers—and they saw some improvements in railroading, too.

The Peerless Rubber Manf'g Co. some time ago placed on the market a brand of rubber packing known as the Rainbow brand; it has been found to give good service in air-brake cylinders in place of the usual leather packing. It is in use on some of the largest eastern lines, and seems to wear well, and stand the action of the oil.

L. C. Noble, after twenty years of service, has resigned as superintendent of motive power of the Houston & Texas Central, and accepted an important position with the A. French Spring Company, of Pittsburgh. C. H. Burns, who has long been a division M. M. under Mr. Noble, succeeds him on the H. & T. C.

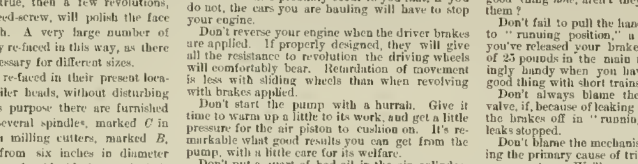
A Valve and Seat Grinder.

The machine shown herewith is a device for refacing valves and seats, instead of grinding them. It prevents bad fitting, insures a full bearing, and accurate work. For grinding valves, the stem and valve-stem box are put between the centers of the machine, as shown in the cut, and the valve revolved by the dog on the cranked spindle. The center of the other end recedes against a spring in the head as the valve is forced against it by the feed-wheel next to the crank. This keeps the valve spindle central, and forces the seat of the valve against the three steel jaws of the stationary chuck, one of which is a cutter. A turn or two cuts the face of the valve true, then a few revolutions, without using the feed-screw, will polish the face of the valve smooth. A very large number of valves can be quickly re-faced in this way, as there is no adjustment necessary for different sizes.

Valve seats can be re-faced in their present locations, on pipes or boiler heads, without disturbing the joints. For this purpose there are furnished with the machine several spindles, marked *C* in the cut, and enough milling cutters, marked *B*, to face all valves from six inches in diameter down. There are several guide blocks, marked *A*. These have threads on the outside to fit all the standard gas-pipe threads up to six inches. With the spindle through one of these guides, and a cutter screwed upon it, the guide is screwed into the body of the valve, in place of the valve-stem box, and the cutter is revolved by a common brace, a ratchet, or a drill press of some kind. When the seat has been cut down enough, the collar, *D*, is screwed fast to the stem on top of the box, and a few revolutions of the cutter polishes the seat up neatly.

Where loose valves are used, they are secured from turning by putting a leather washer between the valve and the stuffing-box, and using the latter to pinch it.

These tools have been made for some years, and are popular where known. They are admirably adapted to railroad work, and should be better known there. They are made by C. F. Hall & Son, Skaneateles, N. Y.



A VALVE AND SEAT GRINDER.

Don't.

The Westinghouse Air Brake Co. have sent out a "Chapter on Dont's," with their instruction book, that is worth preserving and learning by heart. In republishing this we give the Air Brake Co. a pretty good ad. and the ink we are using on this notice is probably worth about $20 per drop to them, still we would not be doing our duty by our readers without giving the Don't chapter in full, so here it is :

Don't think that the present improvement in the Westinghouse Automatic Brake Apparatus isn't necessary, and that the old automatic was good enough. It wasn't, and we'll vouch for it. Some day you'll agree with us, just as you did after a season when the old automatic took the place of the straight air brake.

Don't get impatient when you think the brakes are not operating to your liking, and blame them with containing defects which may exist only in your imagination. It may be that you are not so skillful in handling the brakes as your neighbor. Think a little when such a trouble is upon you. You may find the remedy and learn something more than you already know

Don't blame the fault on the brakes "failing to act," in an accident which may happen your train. It's wonderful how well they acted, and as usual just *before* and *after* such disasters, when anything was left of the train to make a subsequent trial. Somebody might discover this. Maintain your air pressure properly, apply brakes in a reasonable season, and you'll stop promptly as usual. *The Westinghouse Automatic Brake don't fail to act if you have done your duty.*

Don't cut out your driver brakes, imagining they are causing your driving boxes injury. This reasoning was exploded long ago. Keep up your wedges, and you'll have no trouble, we assure you, and you'll have a valuable stopping device which you may some time need. Don't use your driver brake as an emergency device only. You may some time in an emergency not have time to get it to work, or may forget it's on your engine. *Instances of this kind have been known to occur.* Cut it in and use it in conjunction with train brakes *always.* Your train will stop ever so much quicker. It will also probably occur to you that, if you do not, the cars you are hauling will have to stop your engine.

Don't reverse your engine when the driver brakes are applied. If properly designed, they will give all the resistance to revolution the driving wheels will comfortably bear. Retardation of movement is less with sliding wheels than when revolving with brakes applied.

Don't start the pump with a hurrah. Give it time to warm up a little to its work, and get a little pressure for the air piston to cushion on. It's remarkable what good results you can get from the pump, with a little care for its welfare.

Don't put a quart of bad oil in the air cylinder, when a small spoonful of good oil, that won't gum, will do just as well, and put it in at the proper place, *not* the suction openings. Air passages stop up with poor oil, and some time, when you don't want it to, your pump may get hot for you.

Don't fail to have the roundhouse people look after the repairs of your pump when required ; it's not very frequent, but will save money to the company you work for

Don't crowd the pump and attempt to make it do in a minute what can just as well be done in five. It may resent this treatment some time.

Don't fail to keep the piston stuffing-boxes of your pump packed nicely. It prevents the condensation entering the air cylinders and main reservoir. Drain the latter occasionally. Water takes up room better occupied by air

Don't imagine you must have 100 pounds of air, or more, when 70 will produce the greatest braking force the wheels will bear without sliding, if the proportions of the brake gear are properly calculated. This you can readily ascertain to your satisfaction, by making use of the simple rules contained in the instruction book. If they are not, call the attention of the proper official to the matter.

Don't imagine you can stop a long train of cars by operating the brakes on a few of the head ones next the engine, in as short a distance as if the entire number of cars in the train were fitted with brakes, and because you can't, increase your air pressure in an attempt to do so. Half a dozen to ten cars braked will handle a train of 25 to 40 cars quite nicely on ordinary grades, if properly used, but they can be made to do so much and no more.

Don't attempt to stop a train in a few feet, when you have several hundred in which to do it, and no danger impending

Don't set up the rear of a train by applying the brakes suddenly at the head end in an ordinary stop. It's so easily done the right way, and pleasanter to the crew in the caboose. Apply the brakes gently until you have the slack of the train against your engine.

Don't have leaky air pipes around your engines or cars. It isn't economical any more than if so much steam were blowing away, and then it's hard on the pump.

Don't use small main reservoirs on your engines. Big ones don't cost much, if any more, and they hold a lot more air and the brakes operate better with plenty of it. If you can't find room for the big one, you can for the two smaller ones. Don't put the main reservoir on top of the tank. It isn't good practice and you'll regret it some time in winter weather

Don't think that your old friend, the three-way cock, is going to survive always, just because you're used to its ways, and you are just a little loath to try something better in the new brake valve. You'll get used to the new one shortly, and it is really needed, as the injector was when it took the place of your pump. Don't you remember what you said about the change ? Injectors are a good thing *now*, aren't they, since you're used to them ?

Don't fail to pull the handle of your brake valve to "running position," a reasonable time after you've released your brakes. An excess pressure of 25 pounds in the main reservoir comes exceedingly handy when you have a long train. It's a good thing with short trains as well.

Don't always blame the trouble on the brake valve, if, because of leaking air pipes, you can't keep the brakes off in "running position." Have the leaks stopped.

Don't blame the mechanism of the brakes as being the primary cause of triples "sticking" in ordinary practice. We'll assume for the sake of argument, they do sometimes fail to release, but did it ever occur to you that it might possibly be caused by your peculiar method of operating the brakes, or that your main reservoir was too small ? With a fair show, triples don't "stick." Don't argue to the contrary. The facts asserted *can be* demonstrated.

Don't "cut out" the brakes on any cars in the train unless there is something wrong with the brake gear. Even then a little thought and judgment may enable you to apply the remedy. Operate them all. There's just a little trick in doing it on a long train, but you can learn it easily if you'll only try. Here is where the excess pressure comes particularly handy, and helps you out. Besides, you can stop quicker

Don't fail to call the attention of your crew and the inspector to any defect that may exist in the brake gear or apparatus, sufficient to render it inoperative, and that you can't remedy. Prompt repairs may be possible and save you some future anxiety.

Don't get excited because the grades are a little steep. Keep cool and your wits about you, a good supply of air in reserve, *use it judiciously*, and don't fritter it away by unnecessary applications and release of the brakes, and you are perfectly safe on the steepest grades of the ordinary railway

Don't apply the emergency brake except when it is absolutely necessary. The effect of so doing is especially disagreeable to passengers, when you are creeping up to a water crane or a coal chute, and they talk about you, while your passenger department promised them a smoother ride, than *via* the other route. You can make smoother stops if you try.

Don't make more than one application of the brakes in stopping at a station, or two at the v ry outside. Your passengers also notice this and make observations on your skill The traveling public are very knowing and critical these days.

Don't exhaust train pipe pressure to zero in applying brakes. It don't do any good. They are on as hard as they can be applied long before this, and you waste the difference in air. If you've been addicted to this practice in the past, now is a good time to reform. Somebody who knows better will find out your practice and tell it as a joke on you at the roundhouse or lodge room.

Don't leave a terminal station until your brakes have been thoroughly tested, and you are sure they are operating throughout the entire train. Instances *have* occurred when somebody neglected his duty, and didn't open a stop cock, which you found out only when you attempted to make your first stop. It's better to stop a minute in testing brakes before departure, than to muss up things and block the road for several hours ; longer, perhaps, as the wreck crew may be engaged elsewhere.

Don't fail to take up the slack in the brake gear when necessary. If you don't, you can't stop so quickly, and it takes more air when the pistons bottom on the front heads. If your brake gear is weak and contributes to this defect, stiffen it up. It pays to do so, and wooden brake beams are out of date. Metallic beams are cheaper in the long run, and better.

Don't think because a six-wheel truck car has an air brake on it, and shoes acting only upon four pairs of wheels, it can be stopped as quickly as a four wheel truck car. It won't, but it can be made to if shoes are applied to all of the truck wheels, as they ought to be, and it's safer.

Don't fail to clean triple valves and cylinders occasionally. How often, depends upon what goes into the train pipe. Keep out foreign matter, which *should not* get there, and will not if some of these dont's are observed, and you needn't clean them for quite a long season. A half gill of good oil will answer the brake cylinder better than a quart. Economize.

Don't fail to hang up the brake hose in the "dummy" when you uncouple it. Your road may be sandy, and sparks are sometimes thrown by the engine. We've found lots of this stuff in triple valves. It don't do them any good, and annoys the fellows who have to clean them. It's a good idea to blow out the pipes with steam and ease out the fins at their ends before putting them up. It will save you lots of trouble later on.

Don't use the conductor's valve except when absolutely necessary, and then close it immediately after stopping the train, *and before you do anything else*. We suppose you have the cord attached to its handle, traversing the entire length of the car. If you haven't, better make it that way. Cord don't cost a great deal, and it's sometimes handier to pull it from the other end of the car.

Don't for a moment think we are unaware of the fact that the brakes release just a little slower than *you* think they ought. Did it ever occur to you that there was a purpose in having a retarded exhaust of the air in releasing brakes? There is, and a good one. If there wasn't, the exhaust ports would be made larger. Handle the brake properly, and it will release in good season for you.

Don't think, in reading this chapter of "Dont's," we are finding fault with *you*. It's the other fellow, who don't know as much about brakes as you do, and then there's some good advice for him, which, if heeded, may save him a lot of worriment sometimes.

Don't fail to let us know when anything you think serious is the matter with your brakes, that you can't quite size up to your own satisfaction, we'll try and do it for you. It's a pleasure to us, and won't cost you anything. Besides, we want something for our corps of inspectors to do.

Don't alter our standards. We sort of lose the sense of responsibility when you do this, and it is believed these are about right now.

Don't use so-called safety valves in any of the brake appliances to blow off any surplus pressure. Such a practice is wasteful and *dangerous*. Give the governor a little attention occasionally, and it will restrain the pressure to the right figure.

Don't fail to apply a most rigid and searching investigation, if inclined to do so at all, of other alleged *cheaper* and *superior* (?) brakes, which may be brought to your attention, and although you may be told they operate in harmony with your own, demand proof. The claims haven't been substantiated as yet. We've investigated for ourselves, and think we know something on the subject, which may also be interesting to you. Pressure gauges and practical demonstrations in actual service tell tales. It's quite a simple thing to make a brake to operate on a *few* cars. The rub comes in attempting to operate fifty of them coupled together as the Master Car Builders' Association specify. Try it.

The Black Railroader.

On the Houston & Texas Central there are many colored men employed as switchmen and brakemen, and the white men employed with them were, as a rule, disinclined to work with them harmoniously. Recently the white men in the Houston yard struck, but afterward went back to work; the federated board of railway men were down there and patched up the trouble in some way.

The color question in the Southern States is a mighty hard thing to handle. Colored men can be had for small money, they are not organized, and have no means of resisting any wrong, no matter how grievous—and, therefore, wrongs are heaped upon them.

They are not promoted to better positions, and, were the condition of their race equal to that of the whites, they would not seek a hard job at small pay to "learn the business," when there was no hopes of promotion. The question that now confronts the railroad orders is, "What shall we do with the negro train hands?" To demand their dismissal is manifestly unjust, and would meet with little sympathy. To admit them to the associations means future negro engineers and conductors—if they are fit for associates, on a level, they are as worthy of promotion as white members of the same experience.

The colored men seem content in the lowly stations, and will work for smaller pay, and live more miserably in that section of country than white men of the same degree of intelligence. No railroad can do its duty to the public and close its schools of experience, in the shape of employment as brakemen and firemen, and the public, especially the Southern public, would not patronize a road employing colored men in positions of great trust—like running a passenger locomotive. Either way you fix it, it looks rather gloomy for the colored railroader.

Many roads in the South have dismissed all their colored firemen, and others have weeded them out of the train service, but all employ them in yards.

If the railroad orders can fix up a just plan for the adjustment of this question, it might set an example to the legislative sages of the country—they have wrestled with the negro question for years, and have made it worse every time they touched it.

The Reading R. R car shops at Reading, Pa., are very busy, and the company have put up a notice that the 900 employes will be allowed to work fifteen hours per day three days per week, thus increasing their wages. There are plenty of men hard up and out of employment in and around Reading; what is the matter with letting a few of them work ten hours once in a while? Fifteen hours' continuous work is too much for any man—ten hours is long enough.

There has been a company formed in Chicago to manufacture a draw-bar stop, invented by Geo. W Cushing.

Automatic Pressure-retaining Valve.

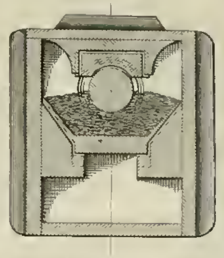
A patent has recently been granted to George Westinghouse, Jr., for a device intended to supplant the "pressure-retaining" valve of the present freight equipment, and thus eliminate the objectionable feature of the necessity of turning a cock on each car at summits. It is also designed to regulate the release of air from triple valve, and to afford a short interval for re-charging auxiliaries between the time of restoring maximum pressure in train pipe, and the actual release of air from brake cylinders.

A bell crank is attached to one of the drawbars of each car, and operates a release valve similar to present pressure-retaining valve in the pipe leading from the release port of the triple. This valve is opened whenever its draw-bar is drawn by the admission of steam to the locomotive cylinders, with the resulting pull on all draw-bars of the train. This elongating motion does not, of course, take place on grades, where the cars "pile up" on the locomotive on release of brakes, and as the draw-bars remain compressed in such cases the air is released under a pressure of twenty pounds, as with the present pressure-retaining valve. On level track, however, draw-bars are drawn on each release of brakes and forward movement of locomotive when given steam, and the new valves being thus opened by the pull on draw-bars, pressure is released without passing under the twenty-pound valve. The interval between the movement of triple valve slides to release, and the release by motion of draw-bars as described, affords an opportunity for re-charging the auxiliaries, so that the entire or partial release of brakes depends on the amount of draft exerted by the locomotive after releasing brakes in the usual way, as the port to outside air is not opened except by a sufficient pull on draw-bars.

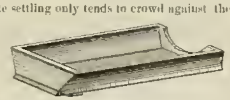
The Pittsburgh Locomotive Works have been obliged to go back to coal for some of their boilers; natural gas got too thin to burn.

An Improved Car Axle Box.

The common car axle box does well enough, so long as the waste packed into it remains saturated with oil, and in contact with the journal, but just as soon as the waste gets rid of part of the oil, and gathers some dirt, it settles and leaves the journal.



Some years ago Stephen B Stinard, of Pompton, N. J., patented a box with inclined sides and a false bottom; this prevented the waste from leaving the journal, but the oil got below the plate, and away from the waste, and it called for a new box He has recently patented an improved oil tray on the same principle, the sides inclined so that the waste settling only tends to crowd against the bottom of the journal,



this tray can be used in a common box, is itself a good dust guard, and is easy to get out to do work on the journal, such as putting in a new brass.

The side lugs that hold up the tray can be bolted into old boxes, or cast in new ones.

The Pittsburgh Locomotive Works are turning out fourteen heavy ten-wheelers for the K. C., Ft. S. & M They are being equipped with the New York air brake. Four of them have Dean guides, and the rest the standard guide and crosshead of the Pittsburgh works. This is an improved Laird guide, being extra strong, and having very large bearing surfaces. The crosshead has a cast-steel fork keyed to the piston, and carrying the pin for the front end of the main rod This pin goes through heavy bosses on each side of the fork, giving a long bearing Around the bosses the side plates fit, and are bolted at the top to the bearing block, between the guides. There are no bolts between the wings and the fork, the fit being entirely around the boss. It is therefore impossible to cramp the crosshead on the guides, and being in four pieces, it is easy to repair. One fork does for all crossheads, the only change needed for an engine having two inches more between the piston and the guide is deeper wings. These works have been building this guide for several years, with no reports of failures. These engines have Mr. McCrum's pot-bellied exhaust-pipe, from which he reports good results. We have no doubt that he gets a steadier blast on his fire, but believe that the use of the indicator will show a back pressure to pay for it

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The town of Maine, Ill., is trying to induce one of the locomotive works, now in an Eastern trance, to move West and locate there What has any of the played-out locomotive works got to move West, except the name? and most of them had better leave that and start new. Most of the works that have dropped out of sight have been forced out because they were behind the times. The West don't want any chain-feed lathes that are good because they built locomotives before the war, or any slippery elm drill presses that are used to locomotive work.

The recent brake trials in Australia were not very complete or satisfactory

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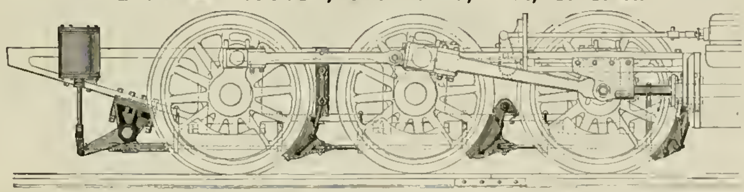

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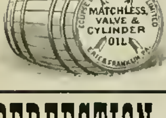

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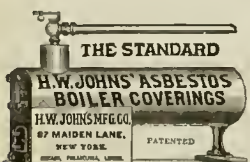

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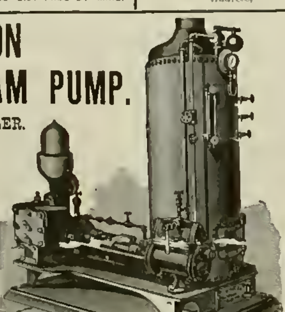

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The Self-Acting Injector of 1887.

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No service on a locomotive sufficiently severe to permanently stop its working

IT WILL RE-START ITSELF

should the Jet break from interruption of the steam or water supply, as soon as the supply is resumed.

ADJUSTS ITSELF

to varying steam pressures without waste of water. Increases quantity of water with increase of steam, and vice versa.

Very easily operated—Started by pulling out the lever, and stopped by pushing the lever in. Descriptive Circular & Price List sent on application to Office & Works,

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LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. III, NO. 12 | NEW YORK, DECEMBER, 1890. | $1.00 per Year or 10c. a copy.

A Typical English Eight-wheeler.

On this page will be found an engraving of a first-class, inside connected, eight-wheeler, of modern English design. Inside connected engines have not been built in the United States for a quarter of a century, and our enginemen are inclined to consider them as out of date as the hook motion.

Mr. Aspinall, the locomotive superintendent of the Lancashire & Yorkshire road, who built this engine, is one of the younger English engineers in charge of motive power, and is considered a very progressive man, his engine is therefore interesting.

As will be seen, the design of the running gear is the American eight-wheeler, but the engine otherwise is a fine example of the English locomotive

She has plate frames, inside cylinders, Joy valve motion, copper fire-box, stays and tubes, inside opening fire-door, the typical English cab, screw reverse gear, and the engineer located on the left side—all English.

Both cylinders are cast in one piece; the exhaust nozzle is single, and as high as the top row of flues, there being nothing in the front end to deflect or guide the gases except a perforated pipe above the nozzle reaching to the stack base, and of the same diameter as the stack. Cast steel wheels are used, braked as shown; the engine is equipped with automatic vacuum brakes.

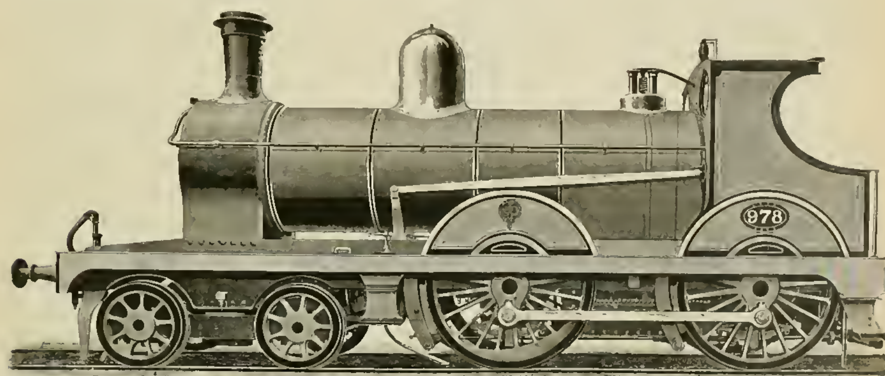
Over each driving box and inside the wheel covers there is a square oil-box, with a cock under it to regulate the flow of oil, then from below the cock three copper pipes extend to the box proper, one to the center, one to the wedge, and one to the shoe. There are other boxes of a similar kind for the trucks and other parts hard to reach, and it is possible to oil all the important parts of this locomotive when in motion.

There are no equalizers, but a pair of heavy springs under each driving box. Coiled springs are used on some of these engines. The form of rod cup, one formed in the rod, with a cover and feed device screwed in, is popular in Europe, and is coming into use here. It never looses off.

This engine has a balanced throttle, of the American type, but the lever is of the grindstone crank pattern.

The principal dimensions are as follows:

	Ft.	In.
Cylinders—		
Diameter		18
Stroke of piston		26
Length of ports		12½
Width of steam port		1⅝
" exhaust port		3¼
Distance from center line of cylinder to valve face		12¼
Lap of slide valve		1
Maximum travel of slide valve.. full		4½
Lead of slide valve ... bare		1/16
Distance between center to center of cylinders		23
Joy's motion—		
Diameter of piston rod		3
Length of slide blocks		13½
" connecting rods between centers		74
Wheels (cast steel)—		
Diameter on tread—driving		72
" " bogie		30½
Crank axle (steel)—		
Diameter at wheel seat		8¼
" of bearings		7¼
" at center		7
Crank axle (steel)—Continued.		
Distance between center to center of bearings		15¼
Length of wheel seats		7
" bearings		9
Diameter of crank bearings		7¼
Length " "		4½
Bogie axle—		
Diameter of wheel seats		6¼
" bearings		5¼
" center		5¼
Distance between center to center of bearing		43
Length of wheel seats		6 1/16
" bearing		9¼
"Main" frames (steel)—		
From center of bogie to back of buffer plate	4	10¼
From center of bogie to center of driving axle	10	2¼
From center of driving axle to center of trailing axle	8	11
From center of trailing axle to end of frame	4	8
Total length of frame plate	28	3
Distance between frames	4	2
Thickness of frames		1
"Bogie" frames (steel)—		
From leading wheel to front of frame	1	5¼
Center to center of bogie wheels	5	6
From hind wheel to end of frame	1	5¼
Total length of frame plate	8	5
Between bogie frames	4	0¼
Thickness of "		0⅞
Boiler (steel)—		
Height from rail to center line of boiler	7	8½



A MODERN ENGLISH EIGHT WHEELER.

	Ft	In
Boiler (steel)—Continued.		
Length of boiler barrel	10	8¾
Diameter of outside of smallest barrel plate	4	2
Thickness of plates		0½
" smoke-box tube plate		0⅞
Pitch of rivets .. full		1⅞
Diameter of rivets		0 11/16
All rivet holes drilled		0¾
Fire-box shell—		
Length outside (steel)	6	
Breadth outside at bottom	4	1
Depth below center line of boiler to bottom of foundation ring	5	1¾
Thickness of throat plate		0⅝
" sides and top plate		0½
" back plate		0½
Pitch of copper stays		4
Diameter of copper stays		0⅞
Roof stays (cast-steel)		
Copper fire box—		
Length of bottom inside	5	4⅜
Breadth "	3	6
Depth from inside of roof to bottom of foundation ring	5	9½
Tubes (copper)—		
Tubes (number) 220		
Length between tube plates	11	1¼
Diameter of tubes		1⅞
Thickness 10 and 12 I.W G.		

Heating surface—Tubes 1121.32 square feet.
Fire box 107.68 "

1229.00 square feet.

Grate area—18¾ square feet

Working pressure, 160 pounds per square inch.

Weight, ready for road

Bogie	30 760	pounds.
Main driver	33 600	"
Trailing	32,360	"
Total	96 720	"

The engine has a six-wheeled tender, carrying 2,000 gallons of water and three tons of coal, and weighing, ready for the road, 60 480 pounds.

We are indebted to the *Railway Engineer*, London, for the engraving and data.

A Sensible Feed Pipe Support.

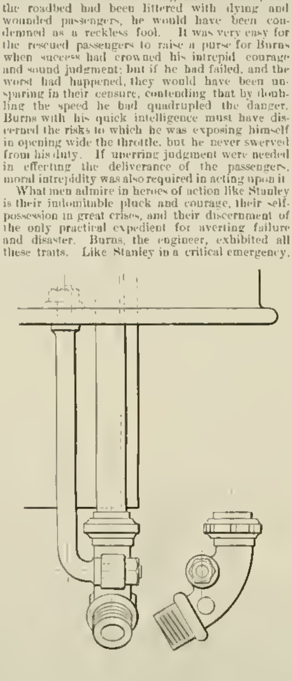
The cuts on this page show, better than we can tell, a sensible scheme for supporting feed pipes, the elbow has a lug that is cored out to receive the supporting rod from the tail casting; it can not cramp, and does not rattle loose and wear holes in the pipe, as the usual clamp device does. This same clamp scheme is a constant source of trouble and expense, forever loose and forever springing enough in service to loosen the joint of the injector pipe This pipe hanger is in use on the B & A , they use ball joints in the injector pipe work, and when they put a union nut on one end of the elbow it goes without bending the hanger with a coal pick.

Heroism and Judgment (?)

The conduct of Engineer Burns in driving an express train through a railway wreck at lightning speed cannot be too highly extolled. It was a most remarkable exhibition of fidelity, self-possession, heroism, and sound judgment. Coming suddenly in sight of the wreck across the track, his mind operated with extraordinary quickness. Th horrors of the situation were appreciated at a glance. The first and natural impulse with ninety-nine engineers out of a hundred would have been to reverse the engine and set the air-brakes in motion. If Burns had done this, and a terrible accident had followed, his conduct would not have been subject to criticism, even if he had jumped from the engine before the wreck was struck He would have had the credit of doing everything in his power to stop the train, and would have escaped censure. Burns did not follow the ordinary impulse of the moment His mind, working with the force of intuition, disclosed the futility of attempting to stop the train at so short a distance from the wreck. There was only one chance of saving the train, and that lay in going ahead at tremendous speed. He took the chance He pulled the throttle wide open, and by the force and momentum of the onset the engine and train cut through a wrecked car loaded with horses, and all was well.

Such incidents as this do not occur frequently, and deserve to be critically studied It was a display of heroism and something more Heroism alone would not have saved the lives of the passengers by the Chicago Limited Burns would have been a hero if he had taken the usual precautions, reversed his engine, and perished with other victims of an inevitable disaster. It was to the combination of unerring judgment and heroism that the passengers owed their lives. There was only one chance of preventing an accident and carrying the train through the wreck in safety That chance was taken; but Burns in that terrible moment must have known that if his train were to be wrecked appearances would be against him Instead of attempting to stop the train he was doubling the speed, and possibly more. If the accident which he succeeded in averting had occurred, and the roadbed had been littered with dying and wounded passengers, he would have been condemned as a reckless fool. It was very easy for the rescued passengers to raise a purse for Burns when success had crowned his intrepid courage and sound judgment; but if he had failed, and the worst had happened, they would have been unsparing in their censure, contending that by doubling the speed he had quadrupled the danger. Burns with his quick intelligence must have discerned the risks to which he was exposing himself in opening wide the throttle, but he never swerved from his duty. If unerring judgment were needed in effecting the deliverance of the passengers, moral intrepidity was also required in acting upon it

What men admire in heroes of action like Stanley is their indomitable pluck and courage, their self-possession in great crises, and their discernment of the only practical expedient for averting failure and disaster. Burns, the engineer, exhibited all these traits. Like Stanley in a critical emergency,



he was a law unto himself. He perceived the only possible way of escape, and he whipped up his racing engine as calmly and resolutely as a jockey on the home stretch drives the spurs into his horse's flanks. His judgment was not paralyzed with apprehension of criticism if he were to fail. He thought only of success and had the moral courage to achieve it.—*New York Tribune.*

This is the worst kind of rot, and shows what outrageously dumphools newspaper men can be when they try. Think of the statement—the wreck was too close to make any attempt to stop, still, Engineer Burns, by "calmly holding the lever and applying his heroic judgment," doubled ("and possibly more") the speed. Burns probably didn't have time to collect his thoughts before the crash came; he ran desperate chances by not doing all in his power to stop at sight of the wreck We do not believe he tried to go faster when he saw the wreck ahead of him—he did nothing until the smash brought him to his senses to find himself a hero (?) Even if he did the best thing under the circumstances, it is a bad precedent to follow

The traveling public can thank their lucky stars that "ninety-nine out of a hundred engineers would have applied the air-brakes and reversed their engines under similar circumstances " It is altogether likely that the next hero of this kind will kill himself and about half his passengers.

The Canadian Pacific advertise that all their engines and passenger cars are equipped with the best and safest Krupp steel wheels

The Way Engineer Skeevers Illustrates a Point.

Jim Skeevers runs a freight engine on a road where the men do pretty much as they please—so long as they pull the trains. To be sure, there is a monthly bulletin of coal and oil used and repairs made, but no one is censured for using too much or complimented or paid for using little. The firemen are not required to clean much and—it's a pretty easy place to get along.

But Skeevers prides himself on economy of fuel and oil, in doing his work well, and getting along with a reason for everything. Among other things, Skeevers likes to see his engine wiped off and the front end and stack neatly blackened, and Skeevers' fireman generally has the neatest looking engine on the road.

Other firemen quit cleaning cab brasses, wiped the jackets about once a week instead of daily, and quit painting the front end altogether long ago. Then they guyed Skeevers' fireman, and called him a fool and a sucker and a chump, till Skeevers' fireman got sick of it and struck for liberty. He didn't wipe the dust off her, and she went out with her front end looking pretty scabby—for Skeevers.

When Skeevers got to the engine in the yard the other day he put his siege-can in the box, got out his overclothes, put them on, and started around with the long can. Billy sat on his seat and smoked a cob pipe

Skeevers got up on the deck, wiped off his can, and remarked rather hintfully

"Forgot to dust her off this time, didn't ye, Bill?"

"No," said Bill, "I got sick of being guyed by the rest of the gang, and called names, and in bein' accused of trying to make firemen do more work, and cleaning for my ride after firing for my day's pay and all that

"Billy," said Skeevers, "it's all right; don't blame you at all. It takes a long time to find out that you know your own business best. Now, haven't you often heard it from all quarters that we had the best-looking engine on the road? Yes, 'corse you have. Don't she run lightest on coal and on oil? Never was beat. Do you have to wipe a dose off her once a year because she was too full of water? No, because we are careful and take pains in our work. We may be suckers, but it's a good deal of satisfaction for me to know we're doin' our work about right—near as we can, anyhow But it's wrong, I guess, Billy, dead wrong, after all. So let's do as the rest do, you fire and clean just as the other boys do, and I'll run just as the other runners do, there's no use in bein' odd."

Billy had expected a row with Skeevers, and felt quite relieved that he took to the change so good-naturedly, and in a few minutes both were busy, as they pulled out with a big train.

Skeevers jammed the injector on full just as they started, and Billy had a hard half-hour's work bringing his green fire up, with the pressure down twenty pounds; he was tired and sweaty when the engine commenced to churn water through her stack, plastering the front windows with dope. Skeevers jerked his head inside the window, smiled, said he forgot it, shut off the injector, and eased off the throttle, then she commenced to howl, and Billy opened the door.

Skeevers was working her down a notch further than usual, and it told on the coal pile, and Billy remarked that it was an awful hard pulling train, by way of calling Skeevers' attention to it, but Skeevers agreed that the train did pull hard.

Skeevers forgot to put the injector on again till the water was down to one gauge, then he acted startled, and put it on full. The fire was low, and Bill had another fight. This was repeated all day, and each time the coal got further and further away

Half-way over the division they took 150 bushels of coal, where they never took more than 100

Skeevers kept good-natured. Bill was mad

"I think you are doin' this a purpose," said Bill, at last.

"Doin' what?" asked Skeevers, as innocent as a child.

"Why, pounding this engine so hard, and workin' water, startin' out in the corner, wide open, and pulling my fire all to pieces"

"Is there any other engine on this road that don't burn more than six tons of coal over this division?" asked Skeevers.

"No; but she never burnt but four and a half and five before," said Billy.

"Yes, but that was when we was both careful and worked together," said Skeevers, as he prepared to get off at the end of the run; "but none of the rest of the engineers are careful about coal, what's the use of me being? And when a man works as hard as you have to-day he would be a fool to put in an extra hour cleaning and fussing around; we get just as much money when we *don't* as when we *do*. Good night, Billy."

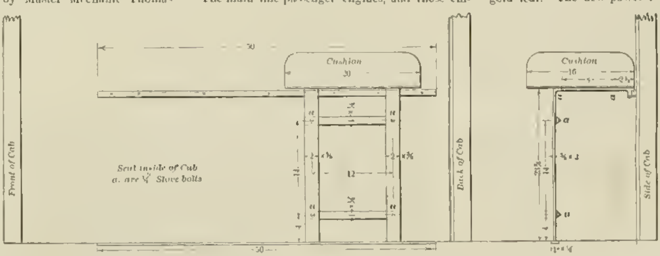
The next morning, when Skeevers came down to go out, the Mary Ann was wiped up, her front end black, and Billy was whistling "Annie Rooney" and spitting on the side windows to make the whiting take hold.

"Skeevers," said he, "I'd a good deal rather put in half an hour a trip cleaning up than to shovel coal against that extra notch and an injector that 'forgits.' Just run her like you used to, Skeevers, and I'll keep her tidy."

Sliding Seat for Switch Engines.

On most switch engines, especially those with short boilers and open cabs, the engineer can only sit down comfortably when going one way, and, in order to be comfortable and see, he stands up about half the time, getting in the way of the fireman, and making himself unhappy.

On the B. & A. switch engines they use a very neat seat designed by Master Mechanic Thomas Purvis, of East Albany. There is no box under the seat, but it cannot be lowered; it can, however, be moved along the entire length of cab, thus allowing the engineer to get his feet either side of the seat, or move it out of his way altogether. The seat frame is made entirely of angle irons, very little machine work being required. The cuts are so plain that an explanation is unnecessary. We have seen the seat in use, and found it very easy to handle, and it is not trappy or "wobbly"—the men kick it where they want it. Try one on some of your scrap heaps where the engineer has to lay on his back to see one way; it will pay.



SLIDING SEAT.

About fourteen readers have written to ask why the release of Westinghouse air-brake is slow, as stated in the chapter of "Dont's," and, replying to all at once, we would say that brake is made to release slowly so that the runner can release gradually as the train comes to a stop, and thus prevent the backward surge of cars caused by stopping with the brake on. Watch a car truck when being stopped with brake on and you will find the truck frame forced down in front and up behind, when the brake is released the truck frame rights with a disagreeable jerk. Try to handle the brake so that it will be just released as the train comes to a stop. You can do it if you try.

We are in receipt of Vol. 1, No. 1, of the *American Federationist*, published at Mattoon, Ill., by W. H. Johnson & Co., and devoted to the interests of the federated railway employes. The first number gives indications of its being a lively and aggressive champion of the cause it represents.

The Westinghouse Air-brake Co. have entered suit against the New York Air-brake Co., to restrain them from using the triple valve. The valves used by the two companies are almost identical, the difference being in detail of construction rather than in principle.

Shops of the Central Vermont.

The Central Vermont road is the lessee of what is known as the consolidated railroads of Vermont, consisting of seven different roads.

The main line of the road runs nearly north and south through the State of Vermont, having a southern connection with all the New England roads, and a northern connection with the Grand Trunk of Canada, by whose lines the C. V. trains reach Montreal.

Compared with western roads it is small, but its 687 10 miles is spread out in the State of Vermont like the spokes of a wheel, making connections with all the other roads around the rock bound rim.

MOTIVE POWER.

They operate some 185 locomotives, some modern, some old-fashioned ones. Quite a number of the old 15 and 16-inch engines are wood burners, and are practically just as they were when new, except that much of the brass has been painted over and air brakes applied.

On a road doing a through business, and using these old engines in freight service, it would be money in their pockets to give them away, but here there is use for them, and at an advantage.

The road has so many branches where light passenger trains of two or three cars are run, that a light engine does it as well, or better than a heavy one, and is easier on track. So it is probable that for many years to come these little old wood burners will pull jerk-water trains on the plug runs of the Green Mountain State.

The main line passenger engines, and those employed on through freight service, are as heavy as can be found in New England, and as modern.

Some of them were built at the shops of the road, but most of them are from well-known builders.

The variety of makes is great, and the variety of sizes still greater, running from cylinders as small as 14, and as large as 20 inches in diameter, and any kind of stroke you want, from 20 to 28 inches.

THE SHOPS.

The main shops of the company are located at St. Albans, in the northern part of the State.

The buildings are good and substantial ones of brick, but most of the tools are old, and there is a dearth of them.

The motive power and rolling stock is under the superintendence of Mr. J. W. Robertson, who has been in the service twenty years, and in his present position about six years.

P. R. R. PLAN.

The enginemen are under the charge of the transportation officers, and not the motive power officers.

THE MAIN SHOP

has pits running lengthwise of and through one side of it, with the tools arranged on the other side.

Some tire turning is done on common or single-head lathes of large swing. There is nothing uncommon in the shop, and few modern facilities for getting out work.

Repairs were being made on some half-dozen engines while we were there, and the work was being done in a very thorough and painstaking manner, the best of materials used, and all modern improvements put upon the engines.

A KINK.

On an old common lathe they have fitted a very efficient device for cleaning flues. It consists of three toothed and corrugated rolls about a foot long, two at the bottom and one at the top, the top roll being hung in a frame that can be swung up by a lever.

This little train of rolls is fast to the tool carriage, and when the lever is swung back, the top roll is out of the way, and a flue can be put into the lathe, there being driven by a chuck; the lever is brought down clamping the tube between the three rolls, pressure being applied by the lever in the hands of the man in charge. The revolving of the tube itself operates the rolls, and the feed of the carriage moves it from end to end.

BRAKES.

The engines for passenger service are all equipped with air brakes and steam heat apparatus, while the freight engines have driver brakes operated by vacuum, steam or air.

INJECTORS.

This is one of the few roads that originally had all the engines equipped with the Hancock inspirator. These instruments are large, as compared with other injectors, set high in the cab, and look odd. They work well, however. The new engines are not coming with inspirators, injectors having been found to require less repairs. Sight feed lubricators are to be seen on many engines.

NAMED ENGINES.

About half the locomotives are named, and the old ones show here and there a bright spot through the black paint, that tells of the days of brass and gold leaf. The new power is black, with a slight stripe, shaded letter, and are nameless.

Rebuilt engines, especially some of the light ones, have red wheels and red stacks.

NUMBER PLATE KINK.

Baldwin engines, with the solid figures cast on the plate, discolor easily by the heat; here they cut out the numbers from brass plate about an eighth thick, and attach them to the plate by half inch long studs. These do not discolor, and look neat and tasty.

OLD PLANS.

Many of the old-timers have underhung links, and eccentric blades of round section with right and left hand sleeve and jam nuts to lengthen and shorten them.

Some have wedges ahead of the box, with each pair of jaws separate, and bolted to the main frame.

BALANCED VALVES

are used in all engines, and great care exercised in fitting up valves and pistons.

ROUNDHOUSES

There are two roundhouses of good size, and during our visit they were busy taking down the doors and swinging them from the outside; they formerly swung in, and could not be closed with one of the new "hogs" in the stall.

KRUPP WHEELS.

For all the passenger car service, and for engine trucks and tenders, they use the best Krupp steel tired wheels, with wrought iron or steel centers of Krupp's make; all tires, both for drivers and other wheels, are fitted with the Mansel retaining ring.

IRON PILOTS

are used, but Mr. Robertson has taken out the crossed heel braces that ran from the pilot heel back to the cylinder saddle, and substituted a heavy, outside heel brace. When an accident bunged up the pilot it was almost impossible to get to these braces to get them down.

EXTENSION FRONTS

are to be seen, and there are a good many balloon stacks for wood, but straight stacks on short fronts is the popular plan for coal burners. These fronts run with the largest nozzle, and throw less fire than the extension or the diamond stacks. The front door has a heavy liner of very rough section, against which the diaphragm throws the cinders, breaking them up; trouble from fires has diminished in proportion to the use of this device.

GOOD PLAN OF BOILER REPAIRS

Mr. Robertson keeps a boiler for each class of engine on hand, either new or in full repair, then when an engine comes in that needs extensive boiler repairs, like a new fire-box, he puts the extra boiler on her frame, and repairs her boiler for the next one.

CAST-IRON

guides are in use on everything, they are of ample proportions, and give no trouble at all, links of cast iron are also used with satisfactory results.

The country through which the road runs is beautiful, the water excellent, engines running for months without washing out; the engines are comfortable, fitted with modern improvements, as a rule, and are light and easy riding.

The men have pleasant jobs. A man who can't run a locomotive successfully and contentedly on the C. V. wouldn't make much of a success at the business anywhere—providing the pay is reasonable there, and we believe it above the average New England pay.

A Tank Cab.

As the cold weather comes on, engineers and firemen begin to kick for back boards and side curtains and other little things to keep out the wind, the snow and the cold.

On consolidated or mogul engines, where the boiler comes through the cab, firemen often suffer from the weather, and better means for their protection needs be employed. The best and cheapest thing for the purpose that we have seen is the tender cab used by M. M. Thos Purves on the B. & A.

On each side of the tank and about a foot back of the extension of the engine cab roof he puts up a tight board or sheet-metal covered side, about three feet wide and just as high as the corners of the cab roof; these sides he joins by a roof, arched to match the engine cab roof.

From the engine cab roof he extends a thin sheet-metal apron, curved to fit the roofs and wide enough to cover the opening between the roofs on any curve.

These sides are considerably back of the tank heads and pretty well enclosing the pit.

The apron between the engine and tank is lengthened to the full width of the tender deck and the side bracket castings are filled with wood, to keep out wind and snow.

The side curtains extend from the engine cab to the tender cab and are carried by a rod fast to the engine cab and sliding in a staple on the tank cab.

With these side curtains up and buttoned the whole pit is well protected, the fireman out of draughts and wet, and if a back curtain is added to the tender cab it is pretty near storm-proof.

The tank cab is also a protection from sun and rain in summer and is so high that it is cool with the side curtains down, there being enough room under it for the fireman to swing his coal pick or handle the longest fire tools.

Old Engines for the South.

Last summer a speculator, who was just a little behind the times, bought some forty locomotives of the B. & A. They were mostly of the class known as "Eddy clocks," and were good engines in their day—but that was ever so long ago.

These engines were taken from the service and sold by the company for $12 per ton, tank and all. They cost the contractor less than $500 each, and he expected to fix them up a little and sell them as second hand engines.

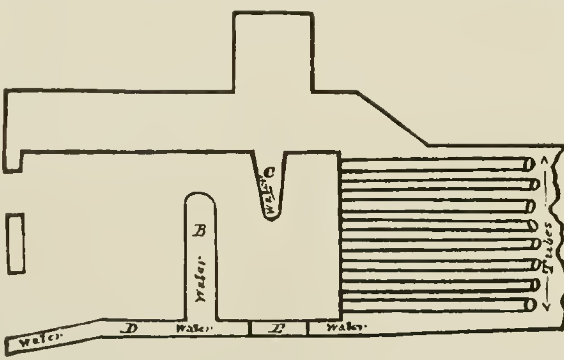
He wrote to all the roads in the South offering them locomotives in running order for $1,000 each, but never sold one, and was obliged to cut them all up—which he could do without loss.

The day when the Southern roads were glad to get anything that would run is gone. They are buying and running as fine motive power as there is on the continent. There is far worse looking and more ancient power in the North now than in the South.

Some Early Fire-box Devices Now Being Re-Invented.

On page 225 will be found cut of a 10-wheeled locomotive with a peculiar boiler, the invention of Wm. G. Norris, a draftsman at the Norris Locomotive Works, he received a patent for this boiler in 1857.

His idea was to place the fire-box above the frames and axles, and thus get the weight better distributed, and admit of placing the forward driver, in 10-wheeled engines, far enough back to admit of the main rod being coupled to it, instead of to the center pair of wheels; but his main object was to get better combustion, and to increase the heating surface. In order to get room under the grates, he raised them up in the fire-box as shown at *G*, and then used a shallow pan from the front to back of the rear axle, where it dropped into a box with slides marked *P*.



SOME OLD FIRE-BOX PATENTS.

Well ahead in the fire-box there was a water wall built entirely across the box as at *A*; this was full of short tubes, through which the flames passed to the combustion chamber marked *C*. The barrel of the boiler *W* was full of tubes to the top. Steam was conveyed from the dome on the wagon top to the cylinders by outside pipes as shown.

This boiler was approved by some roads, and orders given for them, but none were built just this way. The mechanical engineer of the works, Mr. S. Norris, changed the fire-box and built it like the outline shown in Fig. 2, page 224. He employed a water bridge such as have since been patented three or four times, and a deflecting wing or "feather," as it was sometimes called, the barrel of the boiler was full of tubes, but the dry pipe was inside, coming out in a T on top of the boiler, just back of the stack, where the outside steam pipes connected the T with the steam chests.

Engines with this form of boiler were built for many roads; four roads in Cuba were equipped with them, and there were several on the Brooklyn Central & Jamaica, the Long Island, Little Schuylkill, and the East Pennsylvania. One on the latter road we have a record of. She was received by the road in June, 1859, and put into passenger service; she had cylinders 14x24, four 60" wheels connected, and weighed in running order 51,550 pounds, and on July 4, 1859, drew twelve long coaches, excursion laden, up a 52-foot grade without throwing fire. Her regular service being four cars, thirty-seven miles, in ninety minutes, including eleven stops.

The next "improvement" was the omission of the water arch *O*, leaving the wall *B*; many engines were built in this way. In this plan there was an opening at *E* for cleaning out such cinders as were drawn over the wall *B*. These boilers cost more than those with plain boxes, and did not give back enough to cover the extra cost, so they died; but many devices that look surprisingly like their ghosts still bob up and haunt inventors occasionally.

Locomotive Running Repairs.

BY L. C. HITCHCOCK

RODS

Too much care cannot be taken to keep rods the proper length. Some of the troubles which arise when main rods are not kept in this condition are, first (and probably the most dangerous difficulty), there is great liability of breaking the front or back head of the cylinders when the rod is too long, or too short, as the case may be. Then the brasses are not in their proper position in the strap, and if they are too far out of the proper position the supply of oil from the rod cup is in a measure cut off, and the pin will possibly lack proper lubrication. And again, when main rods are not of the proper length it is a more difficult matter to set the valves so that the engine will exhaust regularly, or "beat square," as the boys say. This may not be considered by some to be a very serious difficulty, but it sounds bad, to say the least, and I believe that if an engine does not *sound* square it is not using the steam properly, and an indicator card taken from such an engine would, I think, clearly show that something was wrong. These are some of the effects. Now, why are they produced? I think that the reason the first two effects are produced is very plain. If the rod was too long there would not be sufficient room between the front cylinder head and piston head when the engine was on the forward center, and in case a follower bolt worked loose the cylinder head would be broken sooner, and if the engine was over pumped and water was worked into the cylinder the cylinder head would be more liable to break. If the rod was too short the back cylinder head would suffer in like manner from these causes when the engine was on back center.

When the brasses are not in their proper position in the strap the oil hole through them is thrown out of line with the hole through the strap into which the oil cup is screwed, and where this difficulty exists to a great extent the oil supply is cut off by the hole through the brasses passing beyond the hole through the strap.

The reason an engine will not sound square when the main rods are not of the proper length is, that if the steam is made to cut off at an equal distance from each striking point (as it should be made to do) there will be more space between the piston and cylinder head in one end of the cylinder than in the other when the exhaust takes place, which causes a difference in the sound of the exhaust.

A full explanation of this will more properly come under the head of "Valve Setting," with which we intend to bore the boys at some future time.

When a main rod is put up, the engine should always be pinched on the center, and the distance from the nearest striking point to the end of crosshead be measured. Then, if the engine has 24-inch stroke, lay an opened 24-inch rule on the bottom guide with one end against the crosshead, then measure the distance from the other end of rule to the other striking point. If these two measurements are the same the rod is the proper length. In case there is a difference, one-half of this difference is what the rods need to be altered. Some one may say, why write these things, which any apprentice boy should know? I answer, simply because I have seen machinists who considered themselves pretty good workmen put up main rods without taking these measurements, and the piston head struck the cylinder head the first time an attempt was made to move the engine.

If the rod is down at both ends, a good way to get the proper length is to place the crosshead centrally between the striking points, then the distance from the center of the crosshead pin to the center of the forward main shaft is the length the rod should be from center to center of brasses.

When rod brasses are reduced much care should always be taken to reduce each half square with its edges and sides, as this causes the parting edge of each brass to come squarely together when they are keyed in the strap. The brasses in the forward end of a main rod should be reduced enough, I think, to allow the parting edge of each half to stand a full thirty-second of an inch apart when they are keyed sufficiently tight to the pin, as this will allow the engineer to key them up two or three times before it again becomes necessary to reduce them, and, as these brasses never revolve entirely around the pin, there is less liability of their "hugging" the pin and heating.

I would not advise a person to leave the brasses in the back end of a main rod open, as at each revolution of the driving wheel the pin makes a complete revolution in these brasses, thus increasing the liability of heating if they are keyed too tightly to the pin. They should be reduced so that when the key is driven down solid the brasses will revolve freely on the pin, at the same time having no "pound" or lost motion between them and the pin. This can better be determined by placing them in the strap and keying them to the pin, for when the brasses are put together out of the strap, and only the calipers relied on for the fit, it is only guess-work, as one has to *allow* so much for keying them together, but when a person keys them together on the pin he can revolve them before the end of rod is put into the strap, and he does not need to allow anything, for then he *knows* how they fit.

When making the fit to the pin I would not advise draw-filing the brasses, as this brings the file marks parallel with whatever lines or marks are in the pin, if it is cut in the least, and this makes them more liable to heat and cut. I think the best way is to cross-file, using a rather fine file for the finish. I do not think it necessary to use a scraper for the scraper has had its day for such work. It is better, I think, to give all parts of an engine what space they require with a file than to be compelled to run it around the shops and yard for a week or two that it may free itself before we dare put it into freight service, as was the custom fifteen or twenty years ago.

For brasses in the back end of main rods, I think that those which have babbitt metal inlaid in the bearing surfaces give the best results, as babbitt, being an anti-friction metal, wears the pin smooth.

If any foreign substance gets between the brasses and pin it cuts out the babbitt metal. This causes the brasses and pin to heat, and often melts the babbitt. In case a person has a pair of brasses out of which the babbitt has been melted as described, and the time to make the repair is limited, after the brasses have been nicely fitted to the pin, a good substitute for the babbitt is a piece of sole leather fitted into the slot in brass from which the babbitt was thrown.

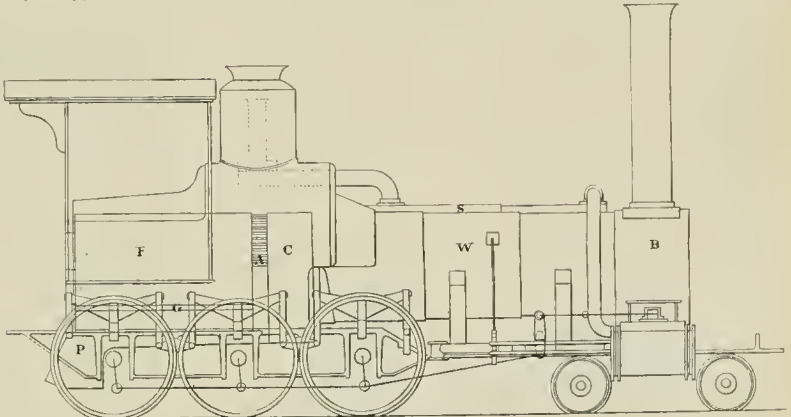
In case the pin is very rough this will be found better than the babbitt, for if any piece of scale from the pin, or piece of foreign matter of any kind (which is hard), gets between the pin and brass it will imbed itself in the leather instead of cutting out a piece, as it would from babbitt. These foreign particles will remain in the leather below the surface and have more of a tendency to wear the pin smooth than otherwise.

A little plumbago and sulphur mixed with tallow put on such a pin before the rod is put up will be found very beneficial.

There are some engineers who imagine that every time they set up a wedge the length of the side rods should be altered. This, I think is a sad mistake. It causes the engineer sadness on account of the way his engine will ride, and the roundhouse foreman, who is expected to keep the engine in good repair, does not feel very jubilant over having to take down the rods and readjust them every trip or two. I believe that a pair of side rods put up in the proper manner should run twelve or fifteen months without being adjusted or having the brasses reduced, provided, of course, that all other parts of the engine are kept in good repair.

SETTING UP WEDGES.

The first thing to do when side rods are to be put up is to see that the wedges are set up properly. This can be done very satisfactorily in the following manner. First have the engine on a piece of straight, level track, then get under and pull down each wedge until it is quite loose, now have the driver pinched as far ahead as possible and held in that position with the bar. Set the wedge up quite snug and try if the driving-box will stick between the wedge and shoe by having another man put a pinch bar ahead of the wheel and both men jump the wheel together. Set the wedge up until the box *does* stick, then draw the wedge down until the box just works freely between wedge and shoe. Treat each wedge in like manner and the wedges will be in a proper position. Now pinch the engine a full revolution on each side and try the trams on the main centers and pins at different points to see if the main centers and pin centers tram correctly. If they do, see that each brass is fitted so it can be keyed solid in the strap and still be perfectly free on the pin; then put the engine on the center on the side you wish to put the rod up, and put the forward end of the rod up first. Now, if the engine is perfectly cold put the rod up as tight as possible between the pins. I have never known of a case where a side rod was put up too tight between the pins when the engine was perfectly cold. On the other hand, I have seen too many rods put up too loosely between the pins, and when this is the case, the strain (when the engine is warm) will come on the rod bolts and they will be sheared. A side rod can be sprung between the pins if too long, but it cannot be stretched a particle if too short, and, consequently, the rod bolts suffer, though this assertion is not intended to convey the idea that a side rod will run good if too long; for if too long the strain is on the pins, though there is less trouble from a side rod which is a little too long than from one left a little too short.



Wheel Base 20 Feet 9 Inches

SOME OLD FIRE BOX PATENTS.

TRAMMING.

In case the pins do not tram correctly with the main centers, care should be taken to note the greatest difference shown between the pins, then put up the rods as described, being careful to file out of the back half of the back connection the full amount of this difference. This will insure the rod passing over the longest point between the pins without binding. Rods put up in this manner will run nicely when the pins are considerably out of tram, and if the engineer who runs the engine can by any hook or crook be made to believe that he *must* let them alone, I feel confident that no trouble will arise for a long time. But it is a difficult matter to make some engineers believe that their side rods should not be tampered with, and this fact is what makes me pin my faith to solid ended side rods, that is, those whose brasses are pressed into the rod in the form of a bushing, and that have no straps, bolts or keys, for an engineer cannot change the length of these, and in our experience they have always given very good service.

The New Haven road are putting on a straight stack, with considerable taper, and without top ornament. Their old straight stack was loaded down at the top with an immense flare. We knew they would do something about it after we called it an inverted dish-pan, which it resembled. By the way, why is it that everybody calls an open stack a *straight* stack, whether straight or tapered?

New Train Order Holder for Cabs

The accompanying cut shows a new train order holder, the invention of C. E. Biddison, an engineer on the Rock Island road.

It consists of a small box, deep enough to contain a small lamp, and large enough on its side to hold three train orders

The orders are held between two plates of glass, the outer one being hinged at the top so as to admit of inserting and holding the orders in such a way as to be readily seen and kept clean.

The front of the case is inclined, so that the light, when the case is not full, is thrown up in the cab and away from the engineer's eyes.

There is a small slide or damper in the case, which shows a red light when open; this is used as a reminder that orders are necessary or that the red board was out when the engine passed the station.

The device is cheap, and seems to answer all the requirements; the inventor's address is Goodland, Kan.

Some Early Valve Motions.

FOUR ECCENTRICS WITH V HOOKS.

One of the earliest forms of hook motions using four fixed eccentrics—the same as is used with the link—was that designed at the Haigh Foundry in England, although Stevenson and Jackson had already adopted four fixed eccentrics. The reason four eccentrics were first used was to secure lead for both forward and backward motions.

The cut shows the forward motion V hooks engaged with the lower pins of the rockers, the back-up motion being out of gear; the moving of the lever operated a crank in the slot of the arm holding the back-up hangers, and pulled them in and out of gear. Stevenson made his tumbler in the shape of an inverted T, suspending the hooks from the opposite ends of the cross piece, but in this plan the hangers had to be long and inclined toward a central point under the tumbling shaft.

The spring and rounded notches, shown at G, were rather a weak means of holding the motion in the desired place, and soon gave way to a latch and quadrant.

Drop-hook gears differed from V hooks only in the V shaped extension of the hook, which insured the hooks engaging with the pin under all circumstances. The plan of four fixed eccentrics and four separate hooks became the standard and most popular valve motion for freight service, but was wasteful on passenger trains at high speed, which called for the invention of the cut off valve

A Compact Small Forge.

One of the neatest designs for a small forge that we have seen is the one shown on this page, and manufactured by Hugh Crumlish, 80 Virginia street, Buffalo, N. Y. The forge is solid and substantial, and occupies but nineteen inches of floor space, has no exposed parts, no flimsy legs, no fan, and no gears. The blast is furnished by a 16½-inch round bellows, entirely concealed in the base of the forge, the operating handle, as shown, taking up the least possible amount of room. This forge only weighs ninety pounds, and as it occupies so little room is very convenient for construction trains and other places where there is little room

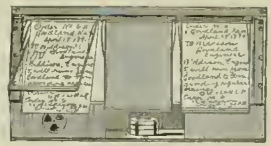
As a rivet forge for bridge and ship work its small size, quiet and steady blast make it popular.

It is the most forge in the least space for the least money we have seen.

The articles on drawing by Orville H. Reynolds are brought to a close in this issue. Mr. Reynolds has given plain instructions in the art of mechanical drawing, avoiding all puzzles and using the plainest of language and scarcely any figures. He has confined his lessons and examples to those that can be followed by a student having but a limited number of tools With these lessons, and a ten-dollar set of drawing tools, any young mechanic can become a good enough draughtsman to make drawings of almost any work he will meet with in the shop.

Automatic Shut-off Cock for Steam Heat.

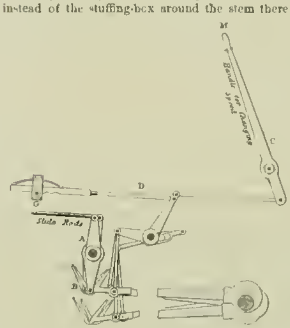
The fear that steam from the locomotive would be as fatal to life, in a railroad wreck, as fire, has called for numerous inventions to prevent its flow, the simplest and most promising of which is shown on page 227. This is a steam valve operated by the pressure in the air brake pipe, and is the invention of J. R. Drozeski, superintendent of the Erie Car Heating Co.'s Works, at Erie, Pa. The valve is ingeniously designed, having no stuffing-boxes



ORDER HOLDER.

whatever, thus doing away with endless trouble in keeping up packing and making the valves move with far less friction; this has been possible because the valve is always either wide open or closed.

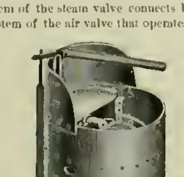
As will be seen by the engraving on page 227, the steam pipe has a plain, straight-way valve in it, but instead of the stuffing-box around the stem there



HOOK MOTION.

is a case with a plain surface at the top, and a projection above the valve head carries a disk of Jenkins packing that is held against the top of the box, forming a steam-tight joint when the valve is open; when it is closed no packing is needed on the stem.

The stem of the steam valve connects by a yoke I to the stem of the air valve that operates it.



CRUMLISH FORGE.

The air valve consists of a cylinder, a piston and rod and a heavy coiled spring, which, in the absence of air pressure, forces the piston down and closes the steam valves.

When air is admitted under the piston it is forced up until it strikes the projection E, which forms an air-tight joint against its packing disk D, on top of piston, and compresses the spring H. So long as there is pressure in the main brake pipe the valve will remain open, but as soon as the brake pipe pressure is removed the heavy coiled spring forces the piston down, closing the valve. On the piston rod, outside of the air cylinder and between it and the steam valve, there is a ring formed on the nut connecting the two stems, that carries a rubber ring which is forced into the coned stuffing-box at the bottom of the air cylinder, thus forming a tight joint when the air is on and the heater cock open. In case there is no air, because the pump fails, or any other cause, the handle G is drawn up by hand, and a slight pressure put upon the button C throws out the catch B and holds the valve open—the catch is shown out in this engraving. The two valves are held in their proper positions by the side pieces P, and connected to the two lines of pipe under the tender, where most convenient.

This is not one of those automatic devices that only operates, or is supposed to operate, in case of accident. It operates every time the air in the train pipe is reduced below the pressure required to compress the spring. Ordinary service stops do not affect it, but the emergency stop will. There is seldom an accident but what the air is applied full, either by the engineer, the trainmen, or by the rupture of the main brake pipe, and it will be considerable satisfaction to know that steam is shut off from the train on these interesting occasions.

Correspondence

Chain-ganging Locomotives and Crews.

Editor The Locomotive Engineer:

The topic for discussion you suggest in the October number—viz., "Chain-ganging engines, or to run them in charge of regular crews," is also to be reported on in the Master Mechanics' Convention in 1891.

It might be dismissed by the dogmatic assertion that there is no way superior to the "one crew on one engine" system. The only reason for chain-ganging would be to get greater mileage, and consequently more service, or to afford the engineers and firemen more rest than can be had by following their engines.

It cannot be gainsaid that on most of our great railway lines the men are run too hard, and do not have sufficient rest, though there are as many extra men kept in reserve as would be needed to relieve any of them that required rest. But it is an every-day occurrence that men do come in who are unfit to make another trip, and there is no one to relieve them, and, not wishing to delay traffic, or disoblige the roundhouse foremen, they go out again. It is an acknowledged fact that a very large share of wrecks that occur are due to men in charge of engines and trains being asleep, or for the want of necessary rest their faculties are blunted, and proper care is not taken to avoid trouble. This fact is concealed by officers and men, for obvious reasons.

The rest afforded to the enginemen by laying off when too tired for further service, and being two or three days in idleness, is not what is required, but a fair amount of rest at each end of the division. This can only be had by having a sufficient number of engines to take care of the traffic, or to chain-gang them. I like the word "pooled" better than chain-ganging.

As regular crews are handled the same every where, we will consider how engines can be pooled to the best advantage. Every good engineer in charge of a regular engine looks upon it as being personal property, and treats it as such, and nothing is too good for it. To pool engines is to treat them as machines, or livery horses, the driver having no care in maintaining them, but simply accomplish the business in hand, and turn them over to the owners to be cared for.

The engineer and fireman on coming on duty should find the engine to which they are assigned in complete order for the trip. No hustling around to get supplies, tools, or to find this or that, but ready in all particulars. This to be done by competent inspectors at each roundhouse. The engines on each division to be as nearly of a class as possible.

On arrival at end of division, engineer to make a careful inspection of engine and report all necessary repairs. In every roundhouse there should be one or more inspectors to examine all parts of the engines thoroughly, such as rod cups, brasses, wheels, and bearings, keep headlights clean, pack all cocks, valve stems, and pistons—in short, do all those duties that ordinarily fall on the engineer when in charge of a regular engine. In all roundhouses there should be a good locker for the engineers and firemen to put their extra clothing, and such conveniences as all men like to have about when on the road. The cleaning of the engines to be done by regularly employed cleaners in each roundhouse. In this it might be well to reserve some part to be taken care of by the road firemen.

In short, the engine is to be treated the same as a sensible man would a good livery horse. It may be said that engineers would lose their knowledge of how to care for an engine. Better this than to injure some wearing part by an ill advised attempt to adjust that which they will have but a short time to observe the effects of, as the same engine may not fall to them in a month again. The care of engines should be taken by traveling engineer and roundhouse inspectors. The record of fuel used and other supplies is a difficult matter to get at, but can be done by measurement of coal at each end of trip, and furnishing the men individual oil cans to be cared for by themselves. But it is my belief that, on the whole, a greater mileage can be made by engines with a regular crew than by pooled engines. But when the power is insufficient to do the work, pooled engines will give the men more and better rest than any other plan, and delay traffic less. GEO. H. BROWN.

Chicago, Ill.

Theory and Practice in Railroading.

Editor The Locomotive Engineer:

In our experience as railroaders how often we see theories upset by practice. Engineers will report hot boxes; the M. M. will storm around, and abuse the machinist for not making a good fit when he put the brasses in; advancing the theory that, had they been a good fit, they would have run all right. The whole secret of the trouble was that the brass fit the journal too well.

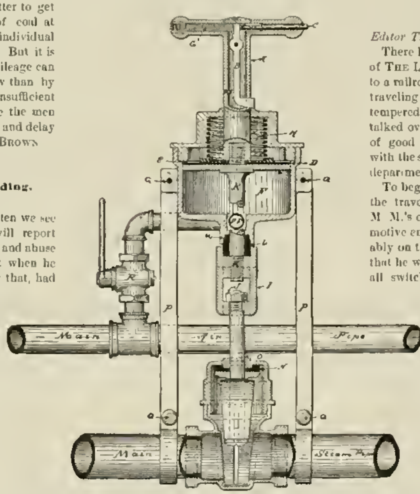
The writer has scraped and filed on a tender brass to get a perfect fit, and when all was said and done, it would warm up before the engine got out of the yard. So much for theory. Practice says don't scrape them at all; use a bastard file, and file them not less than $\frac{1}{16}$ larger than the journal, and they will run all right. I used to work on a road where it was the practice to draw-file (with a bastard file) the journals of tenders and car axles, using a solid brass (no lining metal), and they would run all right, entirely upsetting the theory that a journal had to be perfectly smooth to run well. Some who read this will remember how they put in a brass on the road that did not fit the journal, and that it run all right.

Theory says valves and their seats must be scraped, to be tight, and give good satisfaction. Practice says that planed surfaces, if they are right, are the best for valves and seats; and why? The scraped surfaces are too close for two raw metals of the same kind to come in contact, with good results, as it is nearly impossible to keep any oil between them long enough for them to glaze over; but with planed seats there are a multitude of minute cells that will hold oil, and keep the two surfaces lubricated until a good wearing surface is produced.

I know an M. M. who would take it as an insult for any one to suggest a valve seat planer as superior to the file and scraper, yet the writer's experience is that no railroad shop is complete without one of these little useful machines.

Cab oilers were introduced (not sight feed) to avoid the necessity of the fireman (it always fell to him) crawling out on the running board to oil valves; when the wind was blowing a large percentage of the oil scattered over the jacket. Have seen smart engineers take a hammer and chisel and cut off the oil pipes inside the cab, remarking at the time, "they are no good, *I* want to know where the oil goes;" *they* had a theory born of ignorance, that unless *they* could see the oil in its passage through the pipe that it did not go into the chest, although the reverse lever said very plainly that it struck the right place. The mere fact that in the act of oiling, with their engine shut off, that the oil would disappear about as fast as they could pour it in, they could not get the idea through their thick skulls that the piston was sucking it in; but they had a theory, and the fireman had to go out and oil the valves. This same class of men, when they dropped off at a switch, or got stuck in the snow, found out by practice that injectors were just the thing, after all.

An M. M. had a theory that engine trucks, to run good, must have wrought iron jaws planed, case-hardened, and the face of the jaw ground to make it perfect, it no doubt made a good truck frame, but he put on ordinary chilled wheels, with no certainty that any two of them were the same size. Another man puts on cast-iron jaws as they come from the foundry, the same of the journal boxes, and they run and do good service, and at half the cost, and practice comes out ahead. What about driving tires? Some M. Ms. would be dumfounded to think of sending an engine out without turning off a new tire, and at the same time get one or two years more wear out of the tire by so doing; but they lose sight of the fact that, by examination, over fifty per cent of their engines that are doing good service have a greater variation in the size of their drivers than the new tires would show as they came from the rolling mill, but they have a theory, and the tires must be turned to make it hold good.



DROZESKI'S AUTOMATIC STEAM SHUT-OFF

Theory says side rods must have keys, so their length can be preserved (this length only holds good while the engine is standing in the roundhouse); on the road the key rod and solid end rod are identical.

Theory says soft valve seats wear out faster than hard ones, and practice says they do not. There are engines in service to-day that have been doing work on mountain grades for over twenty years, that have valve seats that chip and file easily, nice close grained soft iron, and they are good for twenty years more—McQueen, Rogers, and Cooke. Yet I have seen engines that destroyed their seats in six months, but the iron was more like rotten wrought-iron than soft cast-iron. A soft seat will wear out a hard valve, and a soft valve will wear out a hard seat. In speaking of hard seats, we do not mean chilled; have run engines with chilled seats and valves; they did good work.

Theory says bad quartering will break side rods, if so, why do they not break in the neck, or close to the stub, where they are weakest? I quoted a case in November LOCOMOTIVE ENGINEER, where an engine broke side rod. Here was an engine in use nearly twenty years, and at the time of the accident she was a poor, old "loose-jointed" affair, did not have a tight place about her, but she broke a rod just the same. Again, if bad quartering has a tendency to break rods, why don't they break when everything is tight and snug, or just after coming out of the shop?

Now, don't let the readers of the best railroad paper in the country understand that I favor shiftless work, for I do not, neither do I favor spending a dollar on a job when twenty-five cents will produce as good results; I believe in having things as near right as possible, and save trouble on the road. No man can tell better than I know, what it is to get over the road under difficulties. Who knows anything about the Baldwin compound? You spoke some time ago about a magnificent Baldwin ten-wheeler on the B. & O. in passenger service; how did she do? You speak of a locomotive works using cast steel rockers; the late A. J. Stevens, of the C. P., used them over fifteen years ago.

Corry, Pa. W. DE SANNO.

The Traveling Engineer.

Editor The Locomotive Engineer:

There has been some discussion in the columns of THE LOCOMOTIVE ENGINEER as to the real value to a railroad company and the enginemen, of the traveling engineer. Some of it was a little hot-tempered, but this subject can be looked at and talked over with just as much reason and exercise of good judgment as any other matter connected with the successful administration of the locomotive department.

To begin with, it will be taken for granted that the traveling engineer is *not* a clerk out of the M. M.'s office, or one of the draftsmen, but a locomotive engineer of considerable experience, preferably on the road where he holds his position, so that he will be acquainted with grades, location of all switches, water tanks and railroad crossings; have a correct idea of the mechanical construction of the different classes of engines in the service, and their weak points as well as their strong ones, so he can judge as to whether the engine is doing her best when her full strength is required. While it is possible for a bright, well-informed man to take this position on a road where he has not seen service before, yet a traveling engineer who knows the road, the engines, and the men, will be better able to take hold and make a good record for efficiency. Of course he must be a progressive man, and not content to follow the old rut *always*, because others were successful that way in past years, for this is a progressive age; the great struggle to haul more tonnage for less money keeps the locomotive department hard pushed all the time.

The small 16 x 24 standard engines of a few years ago could not keep up with the procession, and are being replaced with larger ones, some of them such monsters that their own weight has as much to do with their wearing out and breaking down as the weight of the trains they haul, or the speed they make. Some of them are so complicated that an ordinary man has his hands full to get along with them.

The coal consumption is a question of so much interest now that it pays to have some one to look after that alone. Inexperience or incompetence in the men in charge of the engine can only be remedied by the efforts of some one who has had the experience, can locate the trouble and suggest remedies, which his own experience, or, what is better, his observation of how some successful engineer or fireman handles his engine, or attends to the firing, may call for.

Some engineers make a special effort to keep the coal consumption at the lowest point, with the effect of making a fine art of it. Another one is noted for the small amount of oil and stores that he uses, and the fact that he rarely has a hot box or broken machinery. Another one can draw a heavier train with ease, and actually use a smaller supply of water day by day to do the same work.

than the majority of the others Still another can get a few more miles an hour out of an engine with the same amount of fuel and pressure of steam used by the rest of his fellow engineers. All of these special good points are rarely combined in one man. The observant traveling engineer can, as the saying goes, "get on to" these special advantages, helping out those who do not know how, by his advice and instruction, on the points needed, thus making all of them better. We do not for a moment expect that the T. E. will have all these good points; his best point will be in learning how these records are made, and by what special efforts; then if he has the faculty of telling how it is done, so the others can understand and do likewise, he is a valuable man. A lack of discretion or control of temper will render him unfit for a successful T. E. more than lack of mechanical knowledge. A man right off another road can sometimes do this as well or better than any of the force employed, especially if old fogy notions have to be done away with.

This work the M M cannot do; he cannot give three or four days a week, or a month even, to looking up any of these specialties. If he has a big road, his legitimate duties in the office will not allow of his spending much time on the road, while the M M of a little road of 10 to 30 engines has so many different lines of work to look after that he never finds time to go anywhere. He has to be foreman of the repair shop, keep his eye on the car department, look out for the orders for supplies, give all necessary attention to the maintenance of discipline; in short, he has to give his personal attention to shop and headquarters. If anything goes wrong on the road, trains stall, get out of water, or break down, the train dispatcher has more to do with fixing the blame, while the engineman who was right there at the time is not supposed to be a competent witness, because he is interested in getting out without any blame Therefore, I believe it will pay all large roads to have a competent traveling engineer. The saving of a few tons of coal a day will pay his salary, for when he is successful enough to save that his influence will be felt all along the other lines of expense.

Though *all* master mechanics do not believe it, many of them think that locomotives can be tested with an indicator and then altered to show better steam distribution. Some of the poor steamers waste the steam through the cylinders, while the boiler is doing its best, forcing the fire in this case of course wastes the fuel. Some engineers cure one defect by introducing a worse one, as, for instance, if the exhaust will not cut a fire a foot thick, instead of firing lighter and more even, make the nozzle smaller and pile in more coal. This properly should come under the charge of the T E.; there is no better way to learn about it than to go over the road, see how she does her work and where the defects are located. A more important point in favor of the travelling engineer is, that most of them are the future master mechanics, and it is for the mutual advantage of both companies and enginemen that the business is learned from the bottom up in the school of experience, and—but I'll tell you the rest next month.

Lansing, Mich. C. B. CONGER

Santa Fe Items—Tests With Annular Exhaust Nozzle—New Stack Design—The Strong Front End Experiment New Power.

Editor The Locomotive Engineer :

I notice in your last number your opinion that our annular nozzle, which you illustrate, will cause back pressure in the opposite cylinder. The nozzle was designed to obviate this very trouble, and enclosed cards show with what success. Card No 1 was taken from ordinary nozzle, and has a shoot-over of about 20 lbs Card No. 2 was taken from nozzle you illustrate, and, as you will observe, has no shoot-over. (Both were taken from the same engine, with 140 pounds steam and at starting, they are reduced for this use just one-half.)

This is accomplished by making the area at top of bridge equal to a 4⅛" common nozzle, or the same practically as the final exit at top of nozzle

We find our 18x24 engine required a 4¼" common nozzle to steam, but the nozzle you illustrate steams much better with a 4¼ and 4⅜" opening.

We use an ejector stack all in one piece with the saddle This stack is 23" at the flare of the base, tapered to 15" inside diameter about 20" from the bottom, and then increasing in size to 16¼" at the top

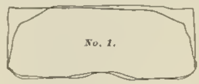
We find engines formerly burning, with old nozzle, 4 tons on certain trips, with new nozzle are down to 2, 2½, and 2¾ tons

We have a Schenectady compound here which promises well. She has the nozzle you illustrated, and steams simply perfect We are now getting out a dynamometer to test the pull of the compound and standard engines.

The Strong engine has not been a success here. Grates that do all right in ordinary fire-boxes last but three weeks in the Strong; her poor circulation caused leaks, which have been measurably stopped by the circulating pipes put in by Mr. Player. In three months' service she has been idle, from enforced causes by failure, two months.

Brick arches are going into everything. Like most other locations where the brick arch "cannot be used," it succeeds when put to the test

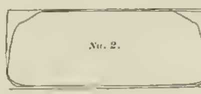
We find a two-inch hole in the front door, or the ring just under the door, very effectual in prevent-



No. 1.

ing ignition of sparks and burning of extension—apparently a large leak having the opposite effect from a small one. Much less black smoke is thrown with the hole open, and either no effect in the steaming is noticed, or better steaming qualities result With a leaky front door, which shows a gradually increasing white spot from burning cinders, the spot stays the same when the two inch plug in door is taken out. In fact, it cures a leaky front end from burning. This is one of the cases in which pure reasoning—like your opinion of the nozzle—is not carried out by facts.

We are getting 150 new engines from Schenectady and Brooks. They are ten-wheel, 19"x24,



No. 2.

with 62" wheel, and are suitable for freight or passenger. The Santa Fe is recovering rapidly in the motive power department from the policy of Mr Player's predecessor, who reduced the output of overhauled engines to ten a month. It is now 28 a month here; and there was plenty of material to work on in the shape of dead engines, too

Topeka, Kan. APPRENTICE.

Burning Cold Air.

Editor The Locomotive Engineer :

In the November issue of the *Master Mechanic* one can see another new-fangled idea for burning cold air in locomotive fire-boxes in place of coal for steam-generating purposes. Such things are in the habit of coming up like the flowers in spring, but the frost in the fall cuts them down to rise no more without planting fresh seed, which is done by some other person; for it appears that one crop always satisfies the most fastidious.

One consulting D. K Clark's work on the locomotive, which was published many years ago (1854) can find a good sample which has all the merit of its successors.

Whenever I see a new crop of these cold air burners I am reminded of an instance that happened in the early 50s, when a railroad company came to the conclusion that to burn coal on their locomotives was a necessity, and the M. M had changed some of the wood burning engines into coal burners, the men all kicking on account of the change, which is always expected when any innovation is to take place, for humanity as a class are orthodox, and engineers are no exception to the rule

The M. M had taken great pains to get posted fully on all the necessities of perfect combustion, how it was necessary to burn all the gas from the coal, and how much cold air it required to do so, besides a hundred others pertaining to this matter. One thing was a fixed fact, and that thing was this: Whenever any fresh coal was put on the fire there *must* be *cold air* admitted to the fire-box above the fuel to burn *that gas and smoke* which, if not burned, there could be no heat had from said coal The above facts being well understood by the M. M, he devised a very ingenious arrangement connected with the fire-door in such a manner that when it was opened to place coal on the fire, it would open a register in the fire-door, and after a sufficient amount of air had passed in to burn the gas and smoke, the engineer was to close the register with his foot, which often times was quite annoying, but the engine did so well it proved a great invention, which was to be applied to all engines that burned coal.

After a few months it was discovered by some one that the opening device for the above register was out of order, and the engineer had failed to report it so repairs might be made, and when the "powers that be" learned of the above facts Mr. Engineer was ordered to appear before the M M, who was a man that sometimes used emphatic language when it appeared to him needed. He could also, when circumstances called for it, talk as smooth as an insurance agent.

Now in this case he was very angry to think that an engineer should slight so great an invention as his register apparatus enough to not have it put in order when needed. There are times when even engineers have luck with them, and this was one of them; for when Mr. Engineer arrived before the awful presence of the said M. M he found a great friend of the M. M's there, who had just called in at that time unexpectedly, and this changed the tone of the M. M. so much that he addressed the engineer as Mr.—a thing unusual—and the following interview took place:

The M M—Mr. Engineer, how came that apparatus broken off your fire-door?

Engineer—I broke it off with a hammer.

"Why did you?"

"It was too much trouble to shut it every time it opened."

At this point the M. M straightened up, took in a long breath and swelled out to his full size, which was of no mean order, and then commenced after this fashion: Mr Engineer, *we have got to burn coal* on our *engines* We know that engineers will have more work to do, but it is the same with all connected with this coal burning, it is more work for the fireman, more work in the shop, we must all take hold and do our share. Now, Mr. Engineer, it is impossible to make steam with coal without the *cold* air; and he went into full details of how much there was needed for each pound of coal, etc His lecture was one that would have done credit to a professor of chemistry, and while this was going on the engineer stood there like a school boy before his teacher—all attention—*i. e.*, taking it all in. At this stage of the game the engineer, who was profane, took a hand and said

Mr. M. M., *when you can make steam out of cold air* I will eat h——l. The curtain dropped, and then came investigation about the engine, which showed that it had been running some time with the apparatus broken, and was doing better without it, and it has been the experience of many that cold air above the fire regulated the amount of steam made, *i. e.*, the *more cold air* the *less steam*.

If all who attempt to do this cold air act had some of the experience of our Mr Engineer it would save lots of trouble and probably some money

Baltimore, Md R. W. CAMEL

A Kicker from Kickersville.

Editor The Locomotive Engineer.

There! I've done it. Gone and written THE LOCOMOTIVE ENGINEER a letter for publication. It's my first offense, and maybe you'll kindly consign it to the waste-basket

I'm one of those "kickers" you read and hear so much about nowadays.

Kick when the (long) time freight I pull is held in yard at end of division two or more hours Kick when I'm forced to double back 150 miles away from home on Saturday night because the extra men are all sick or can't be found. Kick when engines are put in chain gang, and I am called at 2

A. M. to go out in a Minnesota blizzard, with the thermometer registering 40° below zero, and find no packing in the old mill's pistons.

However, I didn't start in to write all the way to New York just to tell you this—put it down, though, that I'm a kicker. I've a kick coming against those fellows who are forever writing in the L. E. and other railway mechanical papers about the density of the average old engineer's ignorance. The young, progressive ones are "all right." The old fellows like myself, though, know next to nothing after spending twenty or more years banging around the country over five or six different roads. I'll admit that I don't know much in one way. I ought to have saved money enough to be independent by this time. I have a progressive cub firing the engine I run at present. The other day cub says to me: "Dad" (this with the air of a man who knows whereof he speaks), "what does water boil at?" I like the cub, but answer with some severity that water boils at 270. Cub laughs immoderately and tells me I'm off. I tell cub that water boils at 270 when the air is all expelled therefrom. I score one on cub and he subsides for balance of trip. Because I'm an old-timer, and don't wear a stand-up collar, cub thinks I never learned to read, and that I spell cow with a "k." I know a good engineer, though, who does. He can draw his check for $25,000, and have it honored too—made it all in Duluth dirt. He can pull as many loads with as little coal as the best of 'em, locate a "blow" or set an eccentric in as little time as if he wrote M. E. after his name.

I've got a kick against the smart man that runs an engine on a light passenger run that never wears rod brasses enough to need filing until engine gets an overhauling; who never has to touch a key after once getting rods in shape, who has five or six hours per day leisure to write about how little we fellows know about hogs, moguls, decapods, etc., and how careless we are in the use of oil and coal, and the way our rod brasses gape open. We work eighteen hours out of the twenty-four, and have found by experience that when an engine has been out of shop twelve to eighteen months and gets hard usage at the hands of different men—some of them "grinders," too—that the brasses can seldom be kept keyed solid. So we do what the most expert machinist would have to do—leave them where they will run and not pull keys out, run hot or break rods. This class of men have been in Co's. service long before the advent of the hog. They have always run light engines on light work. Run 600 miles to the pint of valve oil. Have time to take off cylinder heads every day or two and note condition of cylinders. They are car-pullers, too—in the roundhouse—twenty years ago they pulled twenty-four loads with the old 9-spot—the 9-spot might pull fifteen 60,000 lb. cars now. The hogs now pull about twenty-six. This fellow seldom lets his engine pop. He has no use for a high steam pressure, as there is no danger of his stalling. The engines we run on freight now are no Keeley motors. You can't get something for nothing out of them.

I've a kick against the master mechanic who fails to assist a freight engineer who has barely time to eat or sleep half the time, to locate trouble with his engine. Say, for instance, one that is not able to do the same work as well as others of its class. The engineer often can't tell why. Why is not an indicator put on to learn the cause? M. M. graduated from an engineering school, too. This M. M. promotes all his engineers. If a man comes looking for a job he assumes conclusively that something is wrong with him (M. M. has had five or six jobs himself, too). My progressive stoker thinks the M. M. is right on that one point. Stoker has fired on three roads, but doesn't favor the plan of giving wipers and brakemen the preference for positions as firemen. Well, neither do I. What is the incentive for men to study up their business, beyond enough to keep the job, when so many roads won't hire a man, but promote every one in his turn, regardless of whether he is competent or not?

Men get discharged for causes that ought not to bar them from re-entering the business they have spent years in learning. Some are let out for fast running—burning too much coal—and some in this part of the country quit occasionally. I think if men were hired and kept more on their personal merit, and less on account of their being "old men" (I'm a twenty-year-old myself in railway experience), it might be better for all of us.

I've a final kick against the builders of engines from which you can't see a signal in switching without being a contortionist. I'll make this felt too, some day, when I buy some engines. Why don't they put cabs up where you can see over trains?

This is all I have to kick about this time. I just read over my production to "Mary Ellen," my wife, and she says that while she likes John Alexander's stories much better than this, that she thinks you'll be real mean if you don't print it.

Duluth, Minn. "ZENITH CITEE."

Air Pump Puzzle.

Editor The Locomotive Engineer:

Like De Sanno I have a nut for some air-brake man to crack.

Engine 434 left here Friday P. M. via Auburn road, and when near Rochester the air pump stopped.

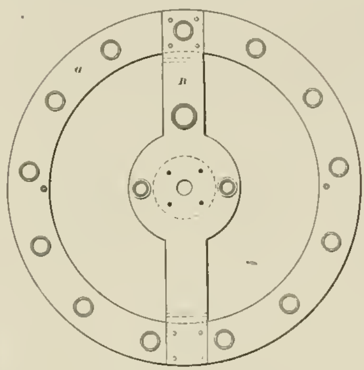
When she got to the engine-house at East Rochester a machinist examined the air pump as thoroughly as he knew how, but could find nothing wrong. After he got the pump together it seemed to work all right, and continued to work until near East Rochester on the return trip, when it stopped again. As soon as he arrived at East Rochester, where the engine-house is, the engineer went in and reported the trouble, and another engine was sent out to take the train. 434 was sent down to Syracuse light. When she arrived I examined the pump and found the defect in the steam cylinder. Some might say that one end of the main steam valve was off, but it was not. The reversing piston was all right, as was also the reversing valve and all its attachments. The main piston and rings were right. Now will some of the readers of THE LOCOMOTIVE ENGINEER tell what the trouble was with this pump? It took me about twenty minutes to fix it.

Syracuse, N. Y. W. F. RELYEA.

Template for Drilling Cylinder Heads.

Editor The Locomotive Engineer:

Herewith find sketch of a template used in the East Albany shops of the Boston & Albany road for drilling the holes in both forward and back cylinder heads without laying off any of them. *A* is cylindrical ring made of ⅜" flange iron. *B* is made of $\frac{5}{16}$" flange iron, cut and flanged as shown, and fastened to ring *A* at each end with four ¼ machine screws. *C* is a brass washer riveted to *B*, and serves as guide to keep template in central position by entering stuffing-box. Bushings are of hardened steel pressed into plates, and admit the required size drill. When used for back head it is held in position by placing bolt through center hole. When used for forward head, small clamps are placed on opposite sides.



CYLINDER HEAD TEMPLATE.

This class of work is done by our cheapest labor.

THOMAS B. PURVES, JR.

East Albany, N. Y.

This issue of THE LOCOMOTIVE ENGINEER will be 24,000. Great demand for specimens among the club raisers.

On another page will be found a "kick" from a "Kicker," but there is method in his kicking, and some good common sense, too. Fancy records of any kind are seldom made on heavy freight engines in hard service, and Kicker makes a point about the comparisons made to his detriment by the fellow with the soft run.

To run long, open, bogie carriages of the American and Colonial pattern would not only prevent the assaults and robberies at present so frequently occurring on our railways, but would put a stop to the numerous false charges of assault made by abandoned females when left with but one fellow passenger in a compartment. We fail to understand why this obsolete type of car riage, which is merely a survival of the old coaching days, should continue to be so tenderly cherished by our railway managers. It is true that it closely resembles the type adopted by George Stephenson, but a good many things have changed since his days, even in this country, and it is about time we had an improved form of railway carriage.—*Railway Herald* (Lon.).

There is a greater amount of freight being moved this fall than there has been for years, yet it is said by railroad officials that very little of it is being carried at a profit, and considerable at an actual loss. This is not because it costs more to move a ton of freight a mile than it used to—it costs less. It is not because the roads are paying their employes too highly—they get less per ton per mile than ever. It is simply because irresponsible agents have been put in authority, and have been allowed to fight and cut down the rates below actual cost of transportation. If the property was theirs, and they alone suffered the consequences of their folly, we could well leave them to their own devices, and let them settle their own fate. But their action stops the payment of dividends, pinching the money market and helping to make hard times; the stockholders insist on retrenchment, and the first cut is invariably in the motive power department, shops are closed or many of the men laid off, trains are abandoned, the power is allowed to run down, accidents multiply, and the value of the property shrinks. Perhaps if the managers would retrench in the traffic departments awhile it might be beneficial.

The Boston & Albany management have ordered all the pilots taken off their freight engines. Pilots are some expense, and the road is thoroughly fenced. They were not quite prepared to adopt the English hooks, or life guards, but they came pretty near it, and are putting on a plain step, such as switch engines carry. The pilot or cow-catcher is an American affair, and answers its purpose of throwing things off the track very well, but where there is little or nothing to throw, and crossings are guarded, there is no reason why the engines won't run as well without it. What the step-ladder front will do in snow remains to be seen.

LOCOMOTIVE ENGINEER. DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.

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CONTENTS

Have But One Object in Sight When on Duty.

Every engineer should train himself to think only of his work while on duty, to lay aside all his troubles, and joys, and hopes, and fears, and aspirations, and think only of that particular engine and train, and how best to bring them to their destination safely, on time, and in the best possible manner known to the art of locomotive engine running.

Just think for a moment, and see if you don't remember of a wreck, and a bad wreck, when in your own mind you are satisfied that it was caused by an engineer thinking of something else—family troubles, religion, love, or real estate.

When you step upon your engine, try to lay aside every other care, and every other thought but the exacting duty in hand.

If you were out riding with a friend, and telling him or her a story, and your horse suddenly took fright and ran away, you would bend every energy to subdue the horse, and then resume your story. Learn to do that on your engine.

Lay aside all engrossing thoughts on religion, love or money, as of secondary importance, until you are at the end of the run, then, if you so desire, take them up where you left off.

The writer once fired for a man who, in this particular, had mastered himself completely; he left all his cares at home—and he had some sad ones—and thought only of his work.

He would sit as rigid as stone for an hour, his hand on the brake valve; his eyes on the track, you would think his thoughts far away, but ask him where any train was, what orders he had, or what that extra click was, and he would tell you in an instant—he was thinking of his work.

He put all his life and soul into his present duty, ask him a question outside of the work in hand, and he invariably replied, "I wasn't thinking about that." This man was afterward killed by a fireman who, after letting their light engine into a siding at night, locked the switch for the side track, and let an express train crash into the engine from behind: the fireman confessed at the hearing that he was thinking about what the Rev. So-and-So said the day before, and forgot what he was doing.

If you are running, remember that your success and reputation does not depend on how good an all round, average man you are, or how much you know about running the master mechanic's office; it depends upon how well you perform your duties each hour and each minute.

The safety of your train does not depend upon your remembering what place you will meet a train that has just left the other end of the line, but upon your knowing where and where not to meet the *next* train.

If you are a fireman, remember that your first duty is to do your particular work the very best you know how, to think of your fire, and all that pertains to its evaporating the most water on the expenditure of the least coal, to think of your signals, your lamps, and of everything under your care; you will rise in the estimation of your engineer and the officers of the road, only on your reputation as a fireman.

You cannot afford to think of anything else than your duty while on an engine, train yourself to this now, it will be of the greatest value when you are promoted.

No man does his whole duty to his employers or to himself when he "thinks about something else" while on a locomotive—do you do it?

Three Years Old—Going On Four.

With this issue THE LOCOMOTIVE ENGINEER completes its third year.

There were a good many people, especially some in the publishing business, who were real sorry for us when the first L. E. came out; one of them wrote:

"THE LOCOMOTIVE ENGINEER came to hand to-day; it is as sparkling as champagne and *ought* to win, but I fear it can't. In the first place, engineers and firemen don't read; they are a class of close-communion hardheads—that will keep you from getting a big subscription list. The master mechanics, etc., are from the ranks, as a class, and are a little more dense and bigoted than the men under them; they pretend to be 'high science' men and take class papers with a high price and a department of puzzles in geometry. The advertisers want to cater to the motive power officers and advertise in the class papers—this will prevent you from getting advertising. I sent out over a thousand specimen copies to locomotive engineers three months ago and have never got one subscriber in return—they won't read."

But we were mean enough to think he didn't know how to strike practical railroad men, bigoted enough to think that we did; and wicked enough to think that he was a sorehead on master mechanics anyway.

We are happy to say that none of his dire calamities have befallen us. All took an interest in the paper from the start, we got some nice advertising—and want more—and the subscription list is now more than double that of any other *two* mechanical papers in the railroad line. Almost every club is increased as it is renewed, and all renew.

The increased size has widened the paper's field and its usefulness and has been duly appreciated. We have no further worry about what support the paper will receive—that is insured—we will now devote our energies to making a better paper.

Watch for This Man.

This is about the season of the year when the Christmas present fiend commences to pass his little list for the names and the dollars of such suckers as will put up. If there is an official on your road who needs a Christmas present, don't stand in the way of his buying himself one. You buy your own. If some official is going away who has been a man among men, and you want to encourage him for it, it might do to give him a present. But a well-written memorial or set of resolutions will show him your appreciation just as well as a gold watch—and is cheaper. If there is an unfortunate fellow worker of your acquaintance, or the needy family of one, put your hand in your pocket and fish up all you can spare. When the man who has the list for the "old man's present" comes around, don't plead poverty, don't sneak away, but say *no* in as clear English as you can command.

If the different orders of railway men would collect and publish a brief account of each of the hundreds of fatal accidents where the victim is not only mangled, but cooked to death, the list would drive nervous people insane. A large part of this torture can be prevented by the use of modern appliances. The practice of perforating boiler heads full of small holes for this cock and that is a bad practice. Checks on the side of the boiler cause sad havoc when a side collision takes place, and cars have a habit of getting out over the switch. Gauge cocks that close from the inside, and that can close automatically when broken off, will work a fair percentage of the time, and save life. Fountain-heads, where one automatic valve closes all communication with the boiler, are good, but the valve should be located inside the boiler and worked every day to keep it in order. This is easier said than done. Anything that will in the least tend to lessen the number of victims of this awful torture is worth trying and using.

There is a very feverish feeling among the road men of two or three Eastern lines, and considerable strike talk. If the officers of these roads would go among the men, and remove three or four little grievances that are annoying, it would stop half the trouble. Men who are constantly harassed by small things are less liable to look reasonably upon larger ones. It will be a cold winter and hard times for a strike. Both sides should avoid it.

The Southern Pacific bought the Northern California road last summer and got some old engines with it, among them two little Norris engines, built in 1851; these engines had cylinders 12 x18", four 54" wheels, and weighed about 16 tons. Both of them had copper tubes that originally came with the engines, one of them had the original copper fire-box and the other had got a new box but a year before.

Books Received.

THE RAILWAY COMPANIES AND RAILWAY BRAKES By N D. Macdonald, Advocate Reprinted from *The Scotsman* by Turnbull & Spears, Edinburgh, Scotland.

This work is a linen-bound pamphlet comprising a series of letters to the press, in which the writer denounces the railroads for using the automatic vacuum brake, and replies from the friends and users of the vacuum device. The author says that in a space of two and one-third years 106 cases of the freezing up of the vacuum brake have been reported—a statement he partially substantiates with day and date. On the other hand, D. Jones, locomotive superintendent of the Highlands Railway, which traverses the coldest part of Great Britain, says that in three years' service of the vacuum on his road not a single case of freezing has been reported No price is stated for this interesting little work, but the Air-Brake Co. should furnish it free—it is a good advertisement

ASKED & ANSWERED.

(69) W. H. J., Conneaut, Ohio, asks:

Can all steam ports be covered at the same time, and in what position will the engine stand if done? *A* —No, One port will always be open the amount of the lead.

(70) W. C. S., Frankfort, N. Y , asks:

Why is the saddle pin placed out of the center of the link? *A* —To equalize the cut-off, and overcome the distortion caused by the angularity of the main rod.

(71) H. M. S , Philadelphia, asks.

How much of the Midland American Railway is completed? It now goes under the name of the Findlay, Ft Wayne & Western *A* —There are no such roads reported as you mention. The Midland (Ind) Railway is 74 miles long

(72) Constant Reader, Birmingham Ala., asks:

Why are offset keys necessary in resetting eccentrics? *A* —They are not necessary unless it is desired to shift the position of the eccentric in order to increase or diminish the lead; then they are used because it is impossible to get a square key into the mismatched key seats in eccentric and axle

(73) Young Runner, Savanna, Ill., writes:

Our ten-wheel engines have the blind driving-wheel in the middle. If tire on back driving-wheel should break and come off, while out on the road how could engine be fixed to run it home? I have asked some old engineers, and it was a puzzle to them They said they could not see how it could be done. *A* —The only way to do would be to block the wheel up so as not to touch the rail, and proceed slowly. Even this would be a doubtful plan. The bald tire should always be ahead in a ten wheeler.

(74) H C. S., Columbus, Ohio, asks;

1. What is foaming, and what is the cause of it? 2. What is the difference between foaming and priming? 3. What will prevent foaming? *A* —1. Foaming is the condition of suds or froth in the boiler, foam. It is caused by foreign substances in the water, such as oil, alkali, soda, etc. 2 Priming is when the whole body of water raises through lack of room to free its steam, or from forcing a boiler too hard It may occur with pure water. Foaming can generally be temporarily remedied by blowing out. Anything that will remove the disturbing foreign matter will stop foaming.

(75) M R. B., Washington, D. C., asks:

1 How many gallons of water will an "old style" Monitor injector, No. 8, throw per minute under 150 pounds pressure of steam? 2 How much will a No. 10 Monitor, of '88, under 180 pounds steam pressure? *A* —The amount of water that any injector will throw depends upon three things—*a*, the pressure of steam; *b*, the size of delivery tube, *c*, the temperature of the feed water. The "old style," "new style," name of maker or any other cause does not change this law The makers of the instrument named say that the No. 8, at 110 pounds pressure, throws 2,430 gallons per hour, and the No. 10, 3,450 gallons per hour at the same pressure—which does not answer your question Experiments made some years ago with a No. 6 Sellers showed that an increase of 10 pounds in the pressure—from 140 to 150—increased the delivery about 2¼ gallons per hour for each pound of pressure added The colder the feed-water, the more steam it will condense, and thus more work can be done and more water is delivered The hotter the feed-water, the less will be thrown. The capacity of a No 10 injector, of any make, with 180 pounds of steam, and the feed-water at 62°, would be very close to 4 000 gallons per hour

On an Eastern road a test was recently made of the wearing qualities of iron and steel axles in actual service. The iron was a high grade fagot-bar from an English maker—the steel was Krupp's standard axle. The axles were the same size, 3⅞x7, and in the same service The iron axle ran 10,608.6 miles to $\frac{1}{32}$ of an inch wear, the steel axle ran 22,366.41 miles for the same amount of wear.

George Stephenson invented and patented in 1833 the steam driver brake.

The Westinghouse air-brake seems to be the winner at all the tournaments of tests lately made in Germany, India and Australia.

At some of the small stations of the Central Vermont road they still use the old-fashioned telegraph machines with paper ribbon attachment

Horace Eddy, M M. of the B. & A., at Springfield, Mass , is putting plain sheet-iron on for jackets and painting it—making a very neat job.

The largest locomotive driving wheels in use are under the London & Northwestern Co.'s engine "Cornwall." They are 8 feet 6 inches in diameter.

Geo. H. Brown, traveling engineer of the C., M. & St. Paul, at Chicago, gives some sensible views in this issue on the chain-ganging of engines and crews.

Keep the index that accompanies this number, and see if the subject on which you seek light has not been touched during the year. If it has, don't ask us to repeat.

The Brotherhood of Locomotive Engineers will meet in convention hereafter but once in two years The next convention will convene at Atlanta, Ga., in 1892. Often enough.

The compound locomotive on the Brooklyn elevated road is reported to be running on much less coal than her neighbors with two cylinders alike. No tests have as yet been made.

The N. Y. C. & H. R R. have given Wm Buchanan, Supt. of M. P., a three months' leave of absence for a trip to Europe. Mr. Buchanan has served as the head of his department for forty years.

The New York Central road has four main tracks, two for passenger and two for freight, and yet it is one of the worst roads in the country for lay-outs—the great trouble being the delay in unloading and loading cars, thus filling up the yards. The traffic is something enormous.

Some Shop Points on the Del. & Hudson Canal.

At the shops of the Delaware & Hudson Canal Co. at Green Island, N Y., Master Mechanic J L. Cory has some little kinks of his own that are ingenious and useful.

Instead of a drop pit, or table, they take wheels out by lifting the engine off of them bodily ; this is done by four hydraulic cylinders. These cylinders are 18x72 inches, and four 2 inch wire cables come down over the stripping pit so that they are a little farther apart than the widest part of the engine, and somewhat nearer together than the extreme length of engine. These tables have a heavy fork end, with pin holes through both sides, and heavy bars about 1½x6 inches are placed under the engine frame at each end and pinned to the fork end of the cables.

The hydraulic pressure is controlled by a three-way cock for each cylinder, all four located together and under the hand of the operator. By this arrangement any corner can be lowered or lifted as desired, one end raised without raising the other, or all four corners lifted at once.

After the wheels are rolled out from under a boiler it is dropped down on dummy trucks and rolled to any point desired.

About eighty pounds pressure is carried in the water-works about the shops. On a car wheel boring mill, originally fitted with a hand or power crane, the chain has been extended and passed around a sheave and up to an hydraulic cylinder overhead, doing the work quicker and easier than by the old method

Hydraulic cylinders also lift pairs of wheels and drivers to the wheel presses.

They have taken an old lathe, big enough to swing drivers, and fitted it up with special gears so that it is driven from a gear on the face plate, same as a wheel lathe, then on the tail-stock they have fitted a quartering attachment of their own design that seems to do the work all right. This lathe develops all the faults and flaws in driver axles as they are shown by the twisting strain put upon the axle, when the tire next the tail-stock is being turned, the wheel at the head's end doing all the driving. This tool has been fitted with two tool posts much like those in use on regular wheel lathes.

Automatic brake rigs on tenders are put up differently here than anywhere else. The triple valve is located under the outside sill on the right side, and in about the center of the tender—this is where it can be seen and got at for inspection and repairs without getting under tender, the drum and brake cylinder being located out of the way under the tank frame. The engineer's valve is on side of cab ahead of the engineer and where it is easily reached, and where it does not get hot.

The engines are all hard coal burners with boilers coming through the cab, but most of the cabs are high on the boiler, and many of them have seats on the side of the boiler for engineer and firemen.

They use short fronts and diamond stacks.

They now make their fire-boxes with a seam in the side sheet about six inches below the crown; below this seam the side sheets are corrugated They have had a great deal of trouble with side sheets, and always below the fire line—a common occurrence with hard coal.

Since the introduction of the corrugated sheet less trouble is had, and they can be renewed from the extra seam down without disturbing the crown, and at comparatively slight expense. They have no trouble with the extra seam leaking. They use stay bolts but three inches apart for side sheets.

Passenger cars are heated by the McElroy system, and in the yard for the storage of cars a complete set of pipes and couplings are provided for each track, and all the cars are coupled up and kept warm, so that when extra cars or trains are called for in cold weather they are ready for the road.

They seem to let freight car axles run as long as they will, as we saw many pairs of wheels in which the bearings were worn to three-fourths the original size.

Old tanks and other sheet metal, instead of going into the scrap, is cut up into washers, a couple of punches being employed on this class of work

The grounds around these shops are nicely kept, and there is altogether about an acre of flower beds. This flower bed addition was put in a little at a time to make the place look cheerful, and from it has grown quite a landscape department, and flowers and foliage plants are to be seen at all important stations on the road.

On one side of the shops there are several large greenhouses, heated by hot water and neatly fitted up as the winter quarters for the plants, of which there are thousands. This department is under the care of Master Mechanic Cory, who seems to be a personal acquaintance to each plant, knows its name, clan, class, habits and previous condition. Ladies who want to see interesting shops should take in those at Green Island.

The D. & H. Canal Co. was the first road to use a locomotive in America—they imported the "Stourbridge Lion" in 1828.

The B. & A. road have an automatic traction increaser that, it is claimed, works very well in its original shape, when not burdened with steam cylinders, etc It is simply a link between the engine and tank, that is fast to the tender draft iron, about a foot below the engine connection. The harder the engine pulls, the more of the weight of the tank is thrown on the drivers. It looks as if all this would make a hard riding tank

Geo. W Wollaston, until recently on the advertising solicitor force of the *Railroad Gazette*, has reformed and gone to work. He is now on the road as sales agent for Pedrick & Ayer, special railway tools, Philadelphia. Representing a first-class house and handling goods in constant demand must be a pleasant change from the bulldog and bouncer interviews of old.

Simple Lessons in Drawing for the Shop.

By ORVILLE H. REYNOLDS.

LAST PAPER.

Having endeavored in these papers to furnish some light for the beginner on a subject which is practically inexhaustible, and having only touched on those portions of it that are absolutely requisite to a successful beginning, we will close the series with this paper, in which we have an example each of intersection of solids and conic sections.

Fig. 94 shows the intersection of two cylindrical surfaces, say a dome and boiler, for illustration.

The problem is to find the shape of curve at junction of the two bodies. First draw end view *B*, Fig. 95, laying off the diameter and height of small cylinder, from which project side view *A*, Fig. 94, and lay off diameter of small cylinder. We now have three points, *D*, *E*, *F*, which were formed by projection from end view. *D* and *F* correspond to shortest length of small cylinder and *E* to its greatest length.

The top view or plan, Fig. 96, is next drawn by laying off from intersection of center lines the diameters of circle *G* and large cylinder *C*.

One-half of circle *G* should be divided into any number of equal parts, say eight, as shown by radial lines *a*, *b*, *c*, etc., after which draw lines *i*, *j*, *k*, etc., through these points, perpendicular to horizontal center line of plan.

Setting the compasses to left of line *m c* on plan, Fig. 96, transfer the dimension to end view, Fig. 95, by taking point *R* for a center, and we have *m'* on end view. Taking on the compasses each point *n o* in turn and transferring to end view as before we have *m' n' o'*, from which vertical lines are drawn to intersect circle *B*, Fig. 95.

These points of intersection are next projected to side view, Fig. 94, and vertical lines *m*, *n*, *o*, let fall to intersect them. Such intersection giving points in the curve sought.

One-half of the curve is shown completed, the other half showing the points only which are to be connected by means of compasses or template as in other cases of irregular curves.

The usual practice in these problems is to lay off one-fourth only of circle *G* and find points in one-half of curve, from which points in other half are transferred with the compasses.

The construction of a conic section is next shown, in which the cone is cut obliquely to the horizontal plane. In this example we have an elevation of that portion of the cone lying below the cutting plane; the upper portion shown by dotted lines, Fig. 98—a horizontal projection of the section, Fig. 97, a projection of the ellipse formed by cutting the cone in the place shown, Fig. 99, and a front elevation showing the cutting plane foreshortened, Fig. 100.

First draw outline of Fig. 97 by taking point *E* for a center on line *A B*, and describe required circle; divide this circle into any number of equal parts, *a*, *b*, *c*, etc., and draw dotted lines from points found to center *E*.

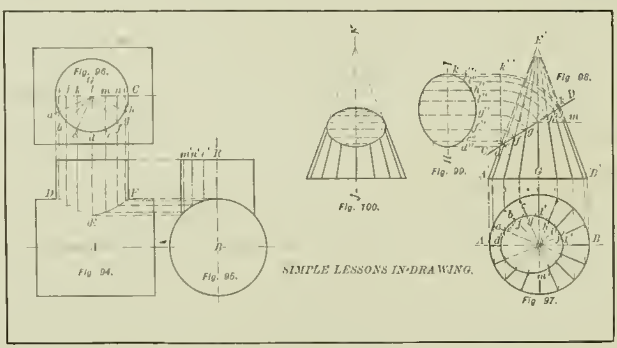
On line *A' B'* project diameter of Fig. 97 and all points on circumference of same figure. Set off on center line the height, *G E'*, and drawing *A' E' B' E'*, also projecting the points on base line *A' B'* to vertex of cone, we have what are called the exterior elements of the cone.

Line *C D* represents the cutting plane, the section of which we are to show on the horizontal projection *A B*. Letting fall perpendiculars from points d and *k* on cutting plane to *d' k'* on line *A B*, Fig. 97, we have the major axis or long diameter of the section, which is an ellipse. Perpendiculars let fall from points *e*, *f*, *g*, etc., on cutting plane to intersect radial lines at *e*, *f*, *g*, respectively, will give points in curve, except on center line *G E*. To find the projection of the points lying on this line, take distance *l m*, Fig. 98, on the dividers and transfer it to both sides of center line *A B* at *l' m'*. The reason for this lies in the fact that all points in the circumference of the cone are equi-distant from the center, in a horizontal plane.

If we suppose the cone to turn on center *G* until *G* assumes the position occupied by *A'*, then *m* will have reached the position occupied by *l* before movement occurred. It is plain that the distance from the center to *m* equals the distance from the center to *l*; we can therefore take *l m* and set it off from *E* on line *A B*, as explained above.

The actual dimensions of the ellipse not showing on the horizontal projection, owing to the obliquity of cutting plane on Fig. 98, they can be obtained by projecting all points on cutting plane to a line passing through *d* perpendicular to base line *A B*. Conceive the cutting plane *C D* to revolve in a vertical plane, on *d* as a center, then *d k''* will equal *d k*. Produce these projected points so as to pass through center line *H I* of proposed ellipse at any convenient distance from Fig. 98.

We have now to find the points in the curve. With the dividers placed on line *A B*, Fig. 97, take the distance *e'* and transfer it to each side of line *H I*, Fig. 99, making the points on projected element *e* at *e*.



SIMPLE LESSONS IN DRAWING.

Taking all the other points in the same manner from the horizontal projection and transferring to Fig. 99, the true dimensions of ellipse are delineated by points which are to be connected as before.

One more view of this conic section is shown in Fig. 100, where we have a front elevation showing the section foreshortened.

Draw outline of cone, using Fig. 97 from which to take the dimensions, and from circumference of same figure take the exterior elements, and transferring them to base line of front elevation produce them to vertex of cone. These elements should be taken from line *A B* and set off from line *J K*. It should be remembered that *A* and *J* represent the same side of cone.

Project to front elevation from Fig. 98 all points in which the elements intersect the cutting plane, as *d*, *e*, *f*, *g*, etc. The intersection of these projected points with the exterior elements of cone will be points in the curve on Fig. 100.

With the belief that any one with a desire to learn the rudiments of drawing can, with proper application, be able to place on paper a drawing of any simple object, we will say once more to the beginner, let no obstacle, however great it may appear, swerve you from your purpose. To persevere means success. As hinted in a former paper, there are so many sources of information to draw from which are practically free to all, that failure is possible only to the apathetic student.

For the benefit of those who would like to pursue the subject further, it is recommended that they procure "Practical Drawing," by J. G. A. Meyer, who has in that work treated the subject not only in a masterly manner, but exhaustively as well.

The work on "Locomotive Construction," by the same author, would also be of material assistance to those interested in locomotive work.

Data Card for Ten-wheeled and Consolidation Engines.

Continuing the subject of keeping data, we show on page 233 Mr. Pomeroy's outline for 10-wheelers and consolidations. like the others it is flexible, and sizes and the position of pieces can be changed with the least amount of work.

The Locomotive Works of Dubs & Co., Glasgow, Scotland.

By C. CRAIGIE YOUNG, GLASGOW.

The city of Glasgow, with its half million of inhabitants, has been appropriately termed the "commercial capital of Scotland." It may be said to be the chief seat of the great Scotch iron and coal trades, and it is likewise the principal center of that great shipbuilding industry in connection with which the river Clyde has long ago become famed. It is here, too, that some of the largest and most flourishing locomotive engineering works in Scotland are situated. One of the best known of these concerns is the firm of Dubs & Co., whose premises I recently had the pleasure of inspecting. These works, which were erected in 1864, are situated on the south side of the river, in the busy district of Polmadie, about one mile and a quarter from the center of city, and cover an area of fully 13 acres. The average number of hands employed is over 2,000 (there are sometimes as many as 2,300), including a considerable proportion of highly skilled artificers. The staff of draftsmen engaged (including apprentices), varies from 40 to 50, according to the amount of work on hand, while there are in addition thereto some score or so of girls employed in making the working tracings. The mechanical operations are carried on in a number of separate blocks, each measuring 300 feet by 280 feet, in parallel spans of 40 feet each, and the required steam power is supplied by sixteen engines of various types, having a combined horse-power of about 900 (indicated). The productive power of the firm is great, the average output amounting to 4 complete locomotives per week, or an aggregate of 200 per annum. Each locomotive weighs on an average about 30 tons, so that the average annual output of the firm amounts in rough figures, to 6,000 tons of new work. The drawing office is one of the largest and best equipped offices of the kind it has ever been my lot to inspect. This room is lighted from the front and back and has separate desks or tables for each draftsman; right down the center of the room runs a broad counter, underneath which are numerous receptacles containing the original drawings of engines and tenders in course of construction.

At one end of this hall is placed a wooden contrivance by which the proper arrangement of the steam valves connected with the cylinders of locomotives is ascertained with mathematical accuracy, thus releasing the draftsmen from a good deal of responsibility and at the same time obviating the risk of error on a point of vital importance to the subsequent smooth working of the engine being designed. It is here worthy of note that the term "designed" has much greater significance in the eyes of the Messrs. Dubs & Co. than it has in some other establishments, as not only must the machine be represented in its complete form as well as in separate parts, as regards its principal sections, but, *every separate bolt and nut must be sim-*

ilarly represented on paper, each with a little sheet to itself, before the engine is made.

After the drawings have been finished and approved they are taken up-stairs to the tracing room, where the girls speedily duplicate or triplicate the originals as may be required, and these are then distributed amongst the artisans outside, the originals being carefully retained inside the drawing office until the work they represent has been finished.

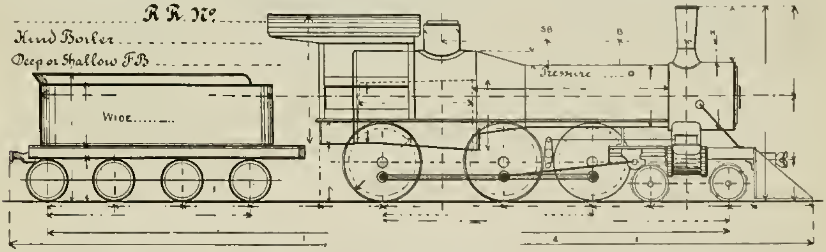
The store-room is located in the same part of the premises. The interior of this place is quite a study in itself, containing as it does a vast collection of tools and other articles in daily use, including a goodly pile of accurate steel gauges, kept for the use of the workmen when preparing a piece of mechanism, thus leaving as little as possible to chance error, and enabling the men to dispense with the ordinary foot-rule. The store contents likewise comprise a number of Whitworth's measuring instruments, with which sizes to .1000 of

shed is one of the busiest "hives" in the whole establishment. This department is supplied with a large number of powerful steam hammers, the blows struck varying from 3 to 60 hundred-weight. The forgings comprise all the malleable parts of locomotives, with the exception of crank axles, which, with steel tires and springs, are the only items not manufactured on the premises.

The boiler makers' shed is closely adjacent to the smiths' shop. Here the visitor is struck with the comparative silence which prevails, which forms a curious contrast to the dismal clang of hammers which is usually associated with the ordinary boiler shed and shipyard where riveting is carried on on an extensive scale. By means of hydraulic apparatus the red-hot rivets are noiselessly squeezed into position in previously drilled holes, and the suspended heavy plates, which but a few minutes before seemed perforated and useless, rapidly assume the form of a well-made boiler, and this under the manipulation of one man and a boy.

rows of pits, engines and tenders are being built, it is not so bewildering; the wheels and axles having passed their appointed routine, are here united in a cold state by the aid of powerful hydraulic presses, which virtually weld them together and render keying unnecessary, although, to satisfy a prejudice which still lingers, wedging is still to some extent used. The locomotive being now mechanically complete is "towed" by the little crane engine above mentioned into the painters' workshop, where it receives its decorations and devices, an operation which is generally begun and finished inside a space of six days.

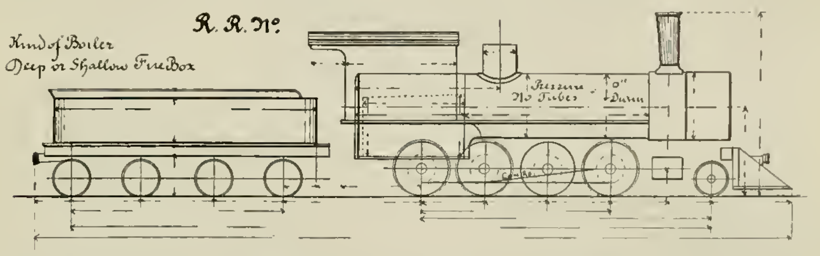
In concluding this brief description of my visit to this celebrated Scotch locomotive establishment I should like to add that I was particularly impressed with the "congenial spot" on which these premises are reared. The natural situation is entirely favorable to the successful development of a concern of this kind. There is in the immediate neighborhood a plenteous supply of coal and iron,



Boiler Material.... Thickness.........
Fire-Box .. x . x Flue Sheet . ..... Crown...
Back . Sides Water Space Sides.. ..Back .....
Method of Staying
Grates, kind ...... x . Area......
Ash-Pan.
Arch Supported by. ....
Heating Surface .... Fire-Box... ... . Tubes

Total
Guides .. . . Crosshead.
Wrist pins x ..Crank pins x
Links ....
Springs, length Hung..
Truck
Weight on Drivers in working order...... . ...lbs
" " Truck " ....lbs.

Weight on Total in working order .. ...lbs.
" " Tender " ... ... lbs.
Spread of Cylinders (centers) Frame
Valve Travel Bridges . x Ex Port . x
Lap o s l s .. Lead Ecc. Throw.
Remarks.



Boiler Material ...Thickness Side Sheets.. . ...
Flue Sheet ... . . .Back ..Crown..
Fire Box . . . in long . . in wide .in deep .
Water space . in front......in sides .. .in back
Method of staying.
Grates, kind ..... . Area...
Ash Pan..
Arch supported by

Heating Surface in Fire Box Tubes
Total....
Guides .. Crosshead
Wrist Pins . Crank Pins
Links, kind .... Dimensions
Springs, length. Hung
Truck, kind
Weight on Drivers in working order lbs

Weight on Truck in working order. ..lbs
" " Total " lbs
Weight of Tender " . . lbs
Spread of Cylinders (centers) ..
Spread of Frame .
Remarks

an inch can be tested, and with which scales can be prepared for the drawing office. Just outside the store-room there is a large open space intersected with various lines of railway, which connect with the different portions of the works. Almost the first thing which attracts attention is a curious little locomotive, surmounted by a steam crane. This locomotive, which was built so far back as 1868, has been appropriately termed an "automatic porter," and has been found extremely useful for picking up large boxes and masses of metal weighing several tons, and depositing them where required. Its peculiar adaptability for such purposes is found in the fact that duplicates have been ordered from the Messrs. Dubs & Co. by other engineering firms and railway companies for their ordinary yard and shunting work. The one I refer to has been constantly at work during these 22 years, and bids fair to stand the strain of several additional years of "toil."

In the pattern shop, I found a number of efficient craftsmen rapidly putting into substantial form the pictured ideas of the draftsmen. The forging

The foundry is close by. They were, at the time of my visit, engaged in casting the cylinders required for immediate use. These are composed of a peculiarly hard and tough material—a mixture of various brands of iron—which the firm have acquired a wide celebrity for producing, and which, we were informed, is greatly sought after by marine engineers for parts of their engines subjected to severe friction. The most central feature in the whole establishment is the mechanical workshop. This department—quite a model workroom of its kind—is open from end to end and covers an area of some 200 feet by 100 feet. It is chiefly occupied by Whitworth's machinery, arranged in parallel rows, for planing, paring, slotting, drilling, milling and polishing purposes. The grinding machines for sharpening the numerous tools in use are also kept here. These machines—we ought to state—are attended to by men who do nothing else, the result being that the chisels, drills, etc., used throughout the factory are always kept in the highest condition of efficiency. In the quieter atmosphere of the erecting shop, where, over double

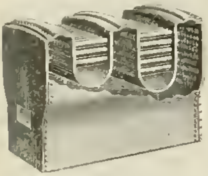
ready communication can be had per rail with all the busy centers of the kingdom, while the shipping accommodation of Glasgow harbor is, with the possible exception of Liverpool, second to none in Great Britain. And this latter remark reminds me of the fact that the Messrs. Dubs & Co. have not failed to take advantage of the facilities for the development of foreign custom thus placed at their doors. In the quarter of a century which has elapsed since they started business on a comparatively humble scale they have supplied locomotives of various types and sizes to railway companies in many distant parts of the world, including Canada, South America, Australia, New Zealand, West Indies, Japan, Cuba and China, and the manner in which the Dubs products are appreciated is seen in the regularity with which repeat orders arrive from the different parts of the globe where these have already undergone the most severe practical tests.

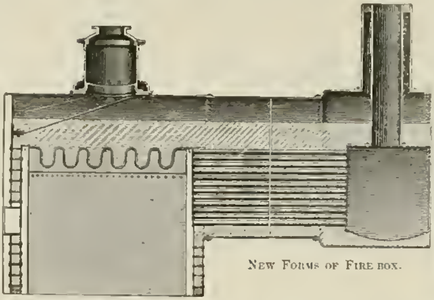
New Form of Fire-box.

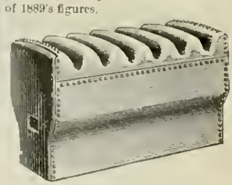
The boiler and two forms of fire-box shown herewith are the invention of Mr. Wm. Malam, lately manager of the boiler department for the Edgemoor Iron Co , at Wilmington, Del. Mr. Malam has had a great many years of experience in boiler making both in England and America.

The surrounded smoke-box was designed more for a torpedo boat boiler than a locomotive. It would put too much weight on the front trucks to be successful and would present practical difficulties in attaching to the cylinder saddles. This, however, is not the important point in his boiler.

The arched and corrugated crown sheet, as shown, would be a grand improvement in locomotive boilers, if it can be made to stand, as it does away with all crown stays, admits of the carrying of a large body of water over the crown, and presents more surface to the action of the fire. The inventor has made a great many practical experiments and is satisfied that he can construct a perfectly safe crown for locomotive use upon this plan.







NEW FORMS OF FIRE BOX.

A few years ago there was neither material nor machines for forming such a sheet as this, but both are plenty now. That such a sheet can be made there is no question. That it will stand in service Mr. Malam is confident, and anxious to build one for trial. The other form of fire-box, with drop legs and short flues, is also his design, but it costs more than the corrugated sheet. His address is 142 Oak street, Paterson, N. J.

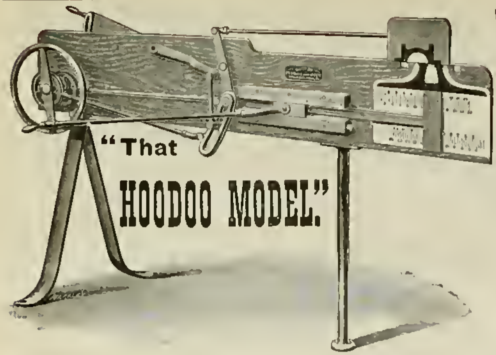
A Heroic Engineer.

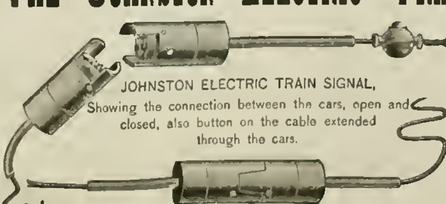
The newspapers have been gushing lately over the act of an engineer who performed an act of questionable bravery , and almost nothing has been said about an act which we consider one of the most heroic of the many noble deeds performed by locomotive engineers. The boiler of an engine which was running wild at night on the Chicago & Erie exploded, and Edward Murphy, the engineer, escaped with severe scalding and a broken leg. An express passenger train was following the engine. Although he was suffering excrutiating pains from the scalding he had received, and the pain of his broken leg was almost beyond endurance, Murphy found a lamp, and crawled back with it to flag the expected train. The act was a sublime instance of devotion of duty.—*National Car and Locomotive Builder.*

The Edgar Thompson Steel Works of Carnegie Phipps & Co , Pittsburgh, made the most tons of steel rails in October that they have yet produced. The output was 32,500 tons, an increase of about 2,500 tons over the previous best month's record. Outside of the Edgar Thomson plant, the best month's work on rails was about 28,000 tons. The total production of steel rails at all the mills in the country for the current year will probably run 400,000 tons ahead of 1889's figures.

James F. Hobart, lately editor of the *Northwestern Mechanic*, has assumed editorial charge of the *Journal of Railway Appliances*. It's funny how men will desert the free and bounteous West to work free lunch routes and wear second-hand clothes in Sodom. Can't hardly account for our own fall.

It is said that the Grant Locomotive Works are actually at work on their new plant near Chicago.


"That
HOODOO MODEL."



GEO. WESTINGHOUSE, JR., PRESIDENT. T. W. WELSH, SUPT. JOHN CALDWELL, TREASURER. W. W. CARD, SECRETARY. H. H. WESTINGHOUSE, GENERAL MANAGER.

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The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped.

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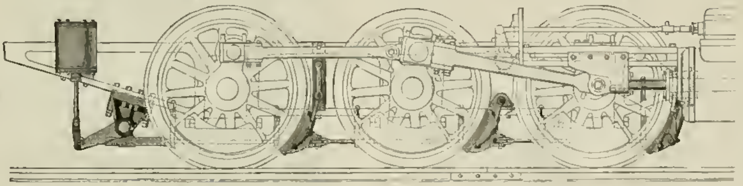

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In regular use on the Erie & Wyoming Valley R. R. (with but one filling each week), the Suburban Rapid Transit R. R. (N. Y. City), and other roads.

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Warranted not to corrode the iron or destroy packing, and to make more mileage than tallow or lard. Sold only to Railroad Companies direct or through our authorized agents. MATCHLESS CYLINDER OIL CANNOT BE BOUGHT OF DEALERS. In use on 60 Railways.

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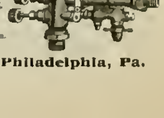

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The Locomotive Engineer.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

1891.

INDEX TO VOLUME IV.

For the Year 1891. — Illustrated Articles are Marked with an Asterisk, thus * — 912 Temple Court, New York City

CORRESPONDENCE.

ASKED AND ANSWERED.

The Locomotive Engineer.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 1 | NEW YORK, JANUARY, 1891. | $1.00 per Year or 10c. a copy.

Improved Swing Truck.

Apropos to the discussion now being carried on by the different railroad clubs on the relative merits of rigid and swing trucks, the new engine truck being put under Canadian Pacific locomotives, and illustrated on this and page 3, is of interest, containing, as it does, some of the better features of each style of truck.

To begin with, the top frame is forged in one piece, both sides and both cross braces, this insures a square truck. The truck is of the well-known floating box style, strongly built, and with the details carefully worked out.

The novel part of the truck is in the swing bolster arrangement. On each side of the swing bolster, or cradle, there is cast a downward projecting lug that bears against a double-coiled spring, held by a central bolt to a heavy brace on the truck frame. It is plain that the bolster of the truck cannot swing either way from the center without compressing one of these heavy springs. Thus the truck is a rigid one until the side thrust upon the flanges exceeds one and a half tons, when the bolster will swing.

A very perceptible improvement in flange wear can be seen since this truck has been put into service. On very crooked track it swings and guides the engine without shock or jerk.

It looks as if it had all the best points of both styles, and was better than either.

Commissioner Rich, of Michigan, one of the best railroad commissioners in the country, has sent out a circular to the railroads of his State, notifying them of his intention to recommend an extension of the time allowed for equipping all the freight cars in the State with M. C. B. self-couplers, but wisely draws the line on cars that have deadwoods or buffers above or on each side of the draw-heads. He says: "The railroad managers are usually of the opinion that considerable hardship would result to railroad companies and shippers by excluding this class of cars from the State, and are disposed to think the danger resulting from their use is overestimated. The trainmen, regardless of the branch of train service in which they are employed, or the company employing them, are universally of the opinion that the cars are unusually dangerous, and that their use, unless equipped with automatic couplers, should be prohibited." If automatic couplers will reduce the number of fatal accidents, by all means let the most dangerous class of rolling stock be equipped first.

The N. Y., N. H. & H. have issued an order against the giving or receiving of presents between men employed on the road. That's business.

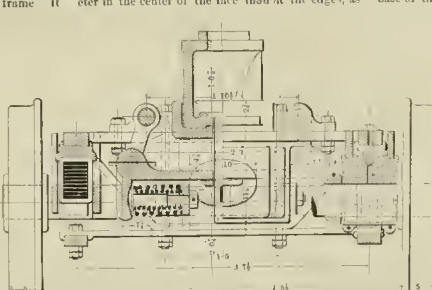
Locomotive Running Repairs.

By L. C. Hitchcock.

SPRINGS.

If a driving spring or engine truck spring is allowed to remain in an engine after the set is nearly gone, it is liable to cause serious damage to the wheel flange.

The theory has often been advanced that if one side of an engine is allowed to remain lower than the other side, the engine will crowd to the higher side, and for proof a belt running over a crowning pulley has been cited. This is an erroneous idea. It is true that a belt will run to the highest point on a pulley face, and this is the reason why some pulleys are made crowning, or left larger in diameter in the center of the face than at the edges, as this will insure the belt running in the center of the face. The principle involved in this case is altogether different from that in an engine with one side lower than the other. The belt principle I think can readily be understood by reference to Fig. 1 (page 2), which represents a belt passing over two pulleys, the face of one having been turned straight, and that of the other crowning; the representation is exaggerated, to better illustrate the principle. Now, the belt when placed at the edge of the crowning pulley will take the position shown by the heavy lines, and will not be in a straight line from one pulley to the other. The edge *A C* will be drawn tighter than the edge *B D*; the bearing *C D* is uniform, but the bearing at *A* is harder than at *B*. When the pulleys are turned on their axis it has a tendency to straighten the belt, and to make the bearing from *A* to *B* uniform; the consequence is that the belt is moved on the crowning pulley to the position indicated by the dotted lines.



A Semi-Rigid Truck.

The cause of an engine sometimes having one side lower than the other is that the weaker spring allows the engine to settle, and the spring on the opposite side, having more "life," raises the engine, consequently more weight is thrown on the weaker spring, and the engine has a tendency to move in that direction, which crowds the wheel flange against the rail. This principle is demonstrated by Fig. 2, which represents a weight, one side of which is raised by means of a lever; this throws a large proportion of the weight on the point *A*, and the weight has a tendency to move in the direction indicated by the arrow; in this case the lever represents the action of the "live" spring, and I think proves that an engine will crowd the wheel flange to the side which carries the weak spring. When a wheel flange begins to cut, it should have immediate attention, for when it is allowed to run in this manner until it is quite sharp, much more has to be turned from the face of the tire to entirely remove the groove worn by the rail at the base of the flange.

The most serious difficulty attending sharp wheel flanges is the liability of derailment, caused by the sharp flange "climbing" the rail at low joints, and at curves.

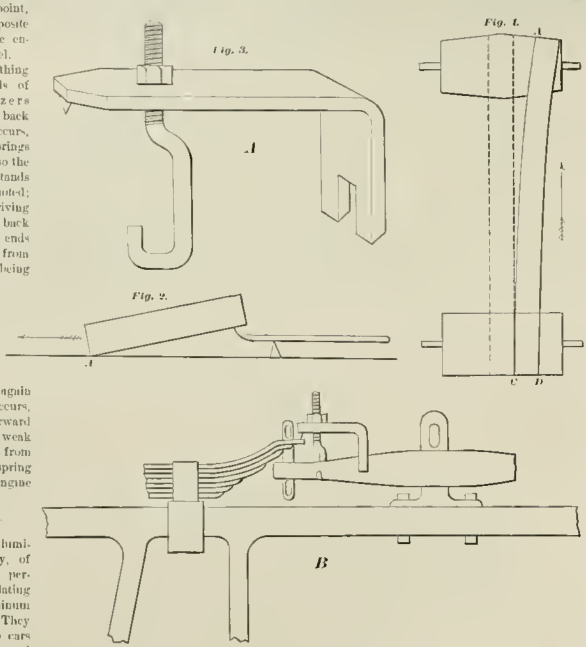
When springs show weakness by allowing the engine to settle, the best way to proceed is to remove the weak spring, and substitute either a new one or one which has been re-set, for when a spring begins to lose its set, clipping it up gives but temporary relief from the trouble, as it will generally straighten out again after the engine has made a trip or two. But it is not always possible to replace an old spring with a new one, as a sufficient number of new springs are not always kept in stock, and where it is necessary to clip driving springs, the old time U piece of iron may be placed between the upper surface of the spring and the hanger gib, and where this is to be done at the back end of the forward driving springs, or at the forward end of the back springs, it can quickly and easily be done by the use of the little arrangement shown in Fig. 3.

Take a piece of 1¼ x8" iron and cut a slot in the end wide enough to take the top edge of the equalizer, bend it as shown at *A*, then as close to the straight end as possible drill a 5/16" hole about ⅜" deep; into this insert a tempered steel pin having a sharp point; the end which contains this pin should be ⅝" wide by 1⅛" high. Then make a hook as shown at *A*, of 1¼ round iron, with straight part threaded; hook this under the equalizer, then slip the bent piece of flat iron over the top end and adjust it to the equalizer and spring as shown at *B*. By screwing down the nut the end of the spring will be lowered when the U piece can be inserted from the opposite side of the hanger from which the pin rests.

When weak engine truck springs allow the engine to settle too much in front, a flat iron ring made in halves is often put in the female center casting to raise the engine; this is not a good practice, as by this means the engine is only raised away from the truck, and the truck frame is as near the top of the truck boxes as it was before. In case it is really necessary to clip an engine truck spring, it should be done by placing the clip between the upper surface of the spring pocket and the lower surface of the truck frame; for in this way the distance between the truck frame and engine remains the same, and the truck frame is raised away from the top of the truck boxes.

When one side of the pilot of an eight-wheeled engine is very high from the rail, and the opposite side is very low, those in charge often order the truck spring on the lower side out, and a new one substituted. Now this may often be the case when neither spring is weak, the fault being the weakness of the back driving spring on the low side, and by replacing this with a good spring the engine is raised at that point, and lowered at the opposite forward point, and the engine is thus brought level.

It is quite a common thing to see the forward ends of driving spring equalizers much lower than the back ends. When this occurs, the forward driving springs should be examined; also the distance that the pilot stands from the rail should be noted; for, if the forward driving springs are weak, the back springs pull the back ends of the equalizers up, and from the fact of the fulcrum being in the center, the forward ends are lowered. Now, if the front end of the engine is too high, too much weight is thrown on the back driving springs, and the results described are again produced. When this occurs, substituting good forward driving springs for the weak ones, or removing clips from above the engine truck spring pockets, will bring the engine and equalizers level.



LOCOMOTIVE RUNNING REPAIRS.

The Harvey Filley Aluminum Plating Company, of Brooklyn, E. D., have perfected a process for plating any metal with aluminum or aluminum bronze. They are now fitting up two cars for the Manhattan elevated with all fittings plated with aluminum bronze, and one car for the Suburban Rapid Transit road in pure aluminum. This plating is white, like silver; will not peel off, and will not tarnish; requires no lacquer and no attention. If it will stand on cab fittings the firemen of the country will bless the inventors of the new process.

The gross receipts of the twenty-three principal railways in the United Kingdom for the week ending November 16, amounted, on 16,235¼ miles, to £1,329,895, and for the corresponding period of 1889, on 16,130¾ miles, to £1,305,473, an increase of 104½ miles, or 0.6 per cent., and an increase of £24,422, or 1 8 per cent.—London *Engineering*.

In round numbers the average length of line of railway in India worked last year was 15,382 miles, upon which the traffic was equivalent to 4,677 millions of passengers, and 3,644 millions of tons of goods carried one mile.

On the railways of India, during 1889, the highest average number of passengers carried in a passenger train was 315.63, on the Madras Railroad, and the smallest, 145.8, on the Indian Midland.

Air-brake Failures.

At the last meeting of the New York Railway Club, Robert A. Parke, Eastern representative of the Westinghouse Air-brake Company, read a paper on air-brake rigging, which pretty effectively covered the alleged causes of air-brake failure. He complimented the engineer some and censured him a good deal, and yet we believe it was deserved.

Engineers are not familiar enough with the details of braking and with the apparatus they handle. The elements of perfect braking are to be found in the automatic air-brake apparatus. Failure can be traced to bad equipment, lack of attention or faulty handling.

The management is responsible for not having driver brakes in constant service, for not using shoes on twelve wheels instead of eight on twelve-wheeled cars, and for lack of attention, inspection and repairs. But the engineer is to blame every time he makes out an accident report saying "the air-brake failed," without stating how it failed, and why. If it failed to hold because he kept applying and releasing it so often near the final stop that the pressure was reduced below a safe pressure for effective work, it was his fault, not the brake, and he should say so. By so doing he commands the respect of his officers, and proves that he has learned a lesson. If the trouble is caused by the brake's failing to hold, and on investigation he finds some of the pistons at full stroke, the fault is lack of attention; let the fault be placed where it belongs.

Every road that attends to its brakes, clean and oil the triple valves once a year at least, and oil the air cylinder every four or six months, when they don't, they invite disaster.

The most trouble comes from slack, and the neglect to take it up. There are travel indicators that tell how many inches the piston moves. These are handy for the car repairer, but if he won't look at the piston he won't pay much more attention to indicators. There are some forms of brake rig that automatically take up the slack when it exceeds a certain amount. Westinghouse should not rest till this feature is added to his brake.

Engineers and firemen had better study the brake from the ground up. Simply saying the "brake failed," will not do. Say *why* it failed. If the cause was the fault of the road's inspection and management, the brake company will sustain you, and if you are discharged for knowing something, or for telling the truth, it will be a recommend for you. Never say it "failed" and you don't know why.

Manager J. E. Chollinger, of the Philadelphia Car Service Association, has issued a report of the operations of the bureau in November. The number of freight cars arriving in the city during the month was 52,617, and the average detention was 1.46 days. Only 3,244 cars were delayed over forty-eight hours, and the detention in these cases was only 2.56 days. The association has been in operation only three months, since September 1st, and in this time 157,320 cars have been handled. Shippers are becoming used to the new arrangement and the efficiency of the organization is increasing. In September the average detention was 1.68 days, and in October it was 1.55 days, and in November it had been reduced to 1.46 days. The number of cars detained over 48 hours has constantly decreased. Of the 157,510 cars handled in the three months, 87,899 belonged to the Pennsylvania and affiliated roads, 59,688 to the Reading, 5,579 to the Wilmington & Northern, and 4,354 to the Baltimore & Ohio.—*Ex.*

The new broad gauge equipment of the Denver & Rio Grande will be cheap power to keep up. There will be the fewest possible patterns and pieces to be kept in stock for repairs. The freight engines are all consolidations of one size, and alike, except the numbers. The passenger engines are ten-wheelers, while the switchers have the passenger engines boiler and cylinders, and the freight engines wheels. All are of the Baldwin build. Mr. Sample has been at the head of the mechanical department of this road from its early childhood, and while the old narrow gauge system climbed the Rocky Mountains time and again, furnishing the very hardest service for motive power, he has kept it up at a remarkably low rate, mostly due to a standard sized engine in the main, and avoiding the building of odd or the buying of strange engines. All the narrow gauges were Baldwins except twenty eight Grants. The broad gauge equipment from pilot to tail lights is as fine and as modern as the best on the continent.

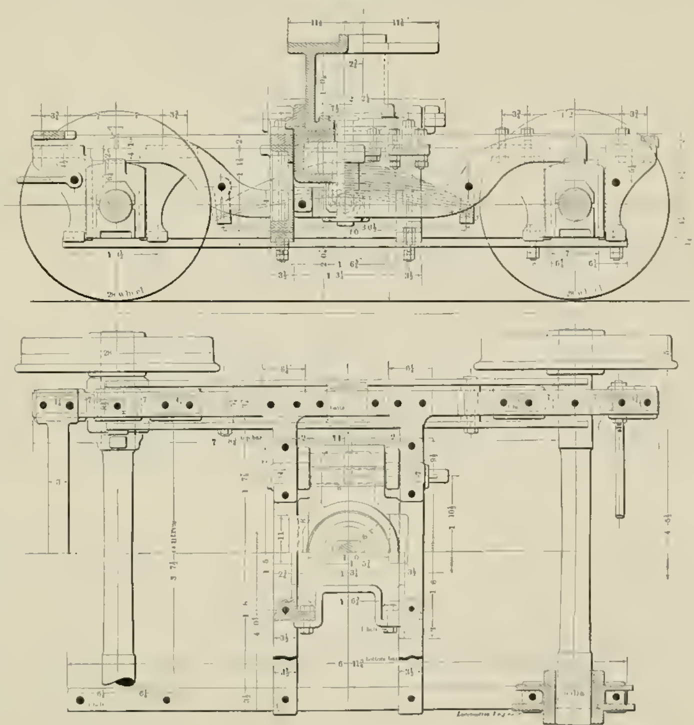
We have a letter from a young man with the firing fever. He modestly describes himself thus: "I am 20 years old, good-looking, of fine address, good parentage, sober, honest, truthful, no bad habits; I may say without a fault or the thought of a fault; do you think there is a place for me on the great iron horse?" We answered him by letter thus: No, honestly, we don't; we don't think there is a place for you on earth—heaven is your home.

The Chicago & West Michigan have a traveling yard master. Few men wear that title in this country.

In locomotive shops it is considered a very fair average of drawing-room force where there is one draftsman for every hundred men employed.

Cause and Effect.

All railroad officers kick about the men trying to manage the road when they resist their right to discharge a man without good and sufficient reasons, which must be stated. Perhaps things are not just as they ought to be, but all of them can have the satisfaction, if it is a satisfaction, of remembering that it has been the injustice and inhumanity of themselves or other railroad officials that have brought the arbitrary demands about. For years it has been customary to discharge somebody for every accident of note on the road; the official in charge must clear his own skirts of the charge of faults of operating, the road of mismanagement; it satisfies the public and prevents comment and perhaps lawsuits, stating, "that upon investigation it is found that Conductor A. and Engineer B. caused the wreck at C." Engineer B. was killed in the wreck, and as it was his fault his widow does not sue; Conductor A. goes away branded, and the official speaks out. Had railroad officials always been decently fair the men would never have organized to defend themselves, as there would have been no cause. But men always go farther than is right in a case of this kind; they feel that interest is due them, and try to make a right out of two wrongs. The unreasonable demands they then make only tend to harden the higher officials against them, until the employes of a road resemble two armies facing each other, a battle being avoided only because each is afraid the other is the stronger. One army is composed of the rank and file demanding better rations, and often offering poor allegiance to the flag for it, the other is composed entirely of officers, who, however able, have the common fault that if a fellow officer becomes a martinet they defend and imitate him instead of courtmartialing him out of the army entirely. Both sides need to use more justice in dealing with the other, they need to "get together" They should be allies, not enemies.



SEMI-RIGID TRUCK

Federation of all men in train service seems to be an established fact. Enough are now enrolled to leave the strictly neutral and "we only" orders in a minority. When strikes cannot be hatched in every hotbed, but must go through the supreme council cooler, there will be fewer of 'em come out alive.

On September 20, 1850, the national legislature made the first land grant to aid a railroad, this was the Mobile & Ohio railroad that had been chartered in 1848.

Get In.

General foremen of railroad shops are entitled to membership in the M. M. Association, and should see to it that their names are enrolled now. Your M. M will recommend you if he is large enough for his place, if not, he may refuse for fear some one will find out that he don't know more than anybody and everybody else on the road. If you are worthy of being general foreman or division master mechanic you are worthy of his endorsement for membership in an association that is for the benefit of your road, your superior officer, and, incidentally, yourself. You don't have to attend a meeting to become a member. You can be enrolled by corresponding with the secretary.

There is a marked tendency toward huge consolidations of business and manufacturing enterprises, of which recent railroad stock purchases are only a small indication. Within a month upward of thirty mower and reaper establishments have been consolidated on a basis of $35,000,000 capital and upward of twenty threshing machine factories on a basis of $20,000,000. Now we hear of a proposition to unite all the lead and silver smelting concerns, for which not less than $35,000,000 capitalization would be required. If the craze for consolidation continues there will presently be nothing left to consolidate. —*New York Press*

Railroads are consolidating in the same way and for the same purpose, *i. e.*, to better their condition. If it is good for them it is good for the men.

At a recent discussion on power plants before the National Electric Light Association, a motto was proposed that would come in first-class for those in charge of locomotives and locomotive firemen. It was "Feed the flames little, feed the fireman well."

Why Piston Rods Break.

In nine cases out of ten where piston rods are broken it is in the taper fit at crosshead, generally through the keyway. An examination at the fracture will generally show that the fit was only at the end of the taper and at the shoulder, caused by driving the key hard enough to stretch the material in the rod at the weakest point, which is where the keyway is located. The crosshead key has so slight a taper that the rod can be broken by driving it too hard. In driving a crosshead key put a block of wood on the piston head end and strike it with a sledge at the moment the key is struck with a soft hammer, and don't strike the key too hard or too often.

The Melbourne *Leader* states that the conference of railway managers, invited to meet at the instance of the South Australian government, may be regarded as the opening incident of a battle of the gauges At the present time there are three different gauges very widely spread on the Australian continent. Of the 3 foot 6 inch gauge there are 3,221 miles, of the 5 foot 3 inch gauge 2,854 miles, and there are upwards of 2,000 miles of the 4 foot 8½ inch gauge in New South Wales During the recent strike the break of gauge between New South Wales and Victoria has been a great disadvantage. —*Engineering* (Eng)

William D. Robinson, founder of the Brotherhood of Locomotive Engineers, and its first grand chief, died on November 8th, of cancer of the stomach. Father Robinson was not always treated as a parent should be by those who enjoyed the privileges he suffered to establish for them.

Compound Locomotive Extraordinary.

The Laredo (Tex.) *Times* says The Mexican National road is expecting every day from the Baldwin Locomotive Works one of the latest pattern compound engines, with three steam cylinders. The third cylinder is to be used for setting brakes, and it is claimed that the heaviest locomotive running at full speed can be "choked" down to a full stop at a distance of 40 feet

The Baldwin works built over 900 locomotives last year.

A modern vestibuled train of six cars is worth in the neighborhood of $100,000—handle 'em easy.

The New-old and the Old-new.

BY W. DE SANNO.

Some months ago mention was made in THE LOCOMOTIVE ENGINEER that iron flags were being used on locomotives. Away back in the early days, iron flags, as signals, were carried on the engines of the old State road (Philadelphia & Columbia), now Philadelphia division of the P. R. R. At that time freight trains were not run at night, or by time card.

Now some of the modern railroaders will say the road could not be worked without some regulation in the running of freight trains, but please remember it was a *double* track road. At the same time we do not claim that the boys did not get together sometimes. The writer has seen the little four-wheeled freight cars of that day piled up like so many packing-boxes, in cases where the following train had found them on a curve. But about those iron flags. They were painted in imitation of the American flag, with the words, "last train" across the end next the staff.

It was useless for any one to try for a ride on a freight train, or for individuals to try to get cars off that day, if the flag had passed. When a flag was not at hand, a stick of wood, with a lot of rags tied around the top, or an old broom stuck in the bumber beam was used; either one was an infallible sign that no more trains would pass that day. We are now speaking of freight trains only. Passenger trains ran on time, unless they were blocked, not by a flag, but by virtue of overhauling one or more freight trains going in the same direction, and on the time of the passenger train.

It was not an unusual thing for two or three freight trains to come into a station, the one pushing the other, with a passenger train bringing up the rear, each little engine doing her best and their valves all on a different key, good, bad and indifferent. How interesting it would be, knowing what we do of modern railroading, if we could go back and see the old-time way of doing things. Passenger trains would run around freight trains at the first crossing or switch they came to.

What interest the writer, as a boy, used to take watching mechanics setting valves in the old times. The engineers would often do the work themselves, but in either case it was done with the steam chest cover off, and a wooden wedge stuck down in the opening to divide the lead. While watching these proceedings the thought did not occur that some day I would take a train and do the same work, with nothing but two little marks on the valve stem as a guide, engine hot, and covers on—one was the old, the other the new way of doing the same thing.

Mention is also made that some roads are putting on plain sheet iron jackets, and painting them. In the early days, boilers were often lagged with beaded lagging, the strips painted alternately black and green, and then varnished, and, with a clean brass band around, the effect was pleasing. Afterwards sheet-iron was put over the lagging, and the iron painted. Some engines had the jacket painted a bright red; have seen the old-fashioned diamond stack painted red. Other roads talk of taking off the pilots, or cow-catcher. The old timers had none. Verily history is repeating itself. In the old time engines, lifting pipes (petticoats) were not used, the exhaust pipes running up into the base of the stack. It is useless to say that the engines would not clean themselves, and it was the fireman's duty to clean out the front end at all water stations. The petticoat was introduced, and the exhaust pipes shortened, with good results. Now comes extension fronts, no petticoats, and the exhaust pipes are creeping up again.

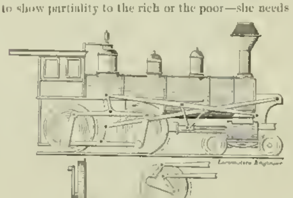
Telegraph for the Fool-killer.

A man signing himself Howard in the New York *Press* gets off the following in regard to the sentence of the semi-religio-society forger Smith:

Judge Fitzgerald thinks that it is worse for an intelligent man of education, high social and business standing to commit a crime than for one who is poor and without the advantages possessed by the other, whereupon he sentences such a one to seventeen years at hard labor in the State prison. The judge would have us infer that he would have sentenced a poorer man less severely.

That's nonsense. The man of refinement, of education, of previous high social and business standing, will suffer more in seventeen days than the other kind of man would suffer in seventeen years. The one falls from wealth and station into disgrace; the other not only doesn't fall from anything, but is pulled up from hunger, from want, and given all that he cares for in life, released from worry with enough to eat and drink, comfortable clothing, a roof over his head, and not one-half the work he would have to perform if he were fighting the world for his bread and butter. Any other kind of talk is clap-trap demagoguery, pure and undefiled, and of the Tammany stripe at that.

That kind of teaching suits some people, and is a good kind to widen the breach and cause trouble; it is what we may well imagine might have been taught by the *rich* and *good* (?) people before the fall of the Roman republic, and what we know was taught by the refined and sensitive (?) demagogues of France that maddened the poorer classes to insist so cruelly upon extermination when they sat in judgment as the commune. The writer of this item assumes that "the poor" are ex convicts anyhow, without hope, ambition, hardly without life—better off in prison. A poor man has no fine feelings; he will not suffer mentally because his family are deprived of his support and company; he is an animal that only knows that he is, and will lay down to sleep when his stomach is filled—unless goaded up to work by those that know what is good for him. Smith was a rich man, a pillar of the church and Sunday-school, a society man, but a robber, a forger, and a thief who carried on his operations for years, hiding them under his cloak of heavenly groans and saintly smiles. America needs no judges to show partiality to the rich or the poor—she needs justice—but it will take a long time for the poor man's judge to get even with the verdicts given for the rich, because they were rich.



AN AWFUL EXAMPLE.

An Awful Example.

William E. Lockwood, the hammer-blow man, has, we fear, great things to answer for in the eternal subsequently. He has said so much about the awful destruction caused by the counterbalance of ordinary locomotives, that half the real made a purpose inventors are at work devising schemes to do away with counterbalances.

Look at this awful example, recently patented by J. M. McMaster, of Rochester, N. Y. This is only one of many.

Lockwood is not a young man, and we sincerely hope that he will see the error of his ways, and repent before it is everlastingly too late. Just think how his children would feel to stand beside a railroad track, and see one of these button-hole attachments go by, and have to think that their father was in any way the instigator of such a criminal abortion of mechanics.

It was announced last month that the master mechanics and the master car builders would hold their next meeting in New York City instead of Cape May. But the executive committees of both associations now announce that the next meeting will be at Cape May, commencing on June 9. Headquarters will be at the Stockton Hotel.

Baldwins are building twenty-seven locomotives for the government of New South Wales, Australia.

The gross earnings of the Union Pacific are about $4,000,000 per month.

Average Pay of Railroad Men.

Carroll D. Wright, Commissioner of Labor, has recently issued his report for 1889, which deals exclusively with railroads. He has taken considerable pains to get the average daily wages of the principal railroad workers in the operative field, compiled from the actual pay rolls, which, reduced to the simplest shape, stands about as follows.

AVERAGE DAILY RATE OF WAGES.

Occupation.	New England.	New York	Georgia	Ohio.
Brakemen	$1.80	$1.73	$1.26	$1.86½
Conductors	2.82	2.54	2.58½	2.61½
Engineers	3.32½	3.15	2.91	3.07½
Firemen	1.69	1.72	1.29½	1.79½
Laborers	1.51	1.23½	.98	1.21½
Tel operators....	1.42½	1.31½	1.50½	1.47
Switchmen	1.78	1.27	1.11	1.63½

RATE OF WAGES—CONTINUED.

Occupation.	Texas	Northwest States	Pacific States.	Average of all.
Brakemen ...	$1.95	$1.75½	$1.96	$1.78
Conductors	2.92½	2.85½	3.00	2.63
Engineers	3.53	2.79½		3.22½
Firemen.	2.04	1.90½		1.79½
Laborers	1.21	1.30	1.87½	1.36
Tel. operators	1.67½	1.38½	2.00½	1.43½
Switchmen .	2.30½	2.15½	2.20	1.60½

It's terrible how roads can stand to pay such wages to men who do nothing but risk their necks, rack their nerves and benumb their brains to get the trains over the roads. It's about time that the fellows that know everything about running railroads got together and fixed the pay of all the hired hands at ninety cents a day—a man can live on ninety cents a day if frugal, look at the Chinese—or else abolish trainmen altogether. Just think of it, presidents of railroads in the good State of New York only getting from $25,000 to $50,000 per year, freight agents only getting $10,000 to $15,000, and engineers sapping the life out of the revenue of the roads at the scandalous rate of $3.15 a day. Horrible, simply horrible.

A Play on Initials.

In the early days of the road, the trainmen changed, for their own use, the reading of the Delaware, Lackawanna and Western to Dam Long & Windy. After the road took in the Morris & Essex the passengers dubbed it the Delay, Linger & Wait. It is more than likely that both had good cause for their christening.

There is a great strike of railroad men in Scotland. The roads are completely tied up. Many factories, gas works, etc., are shut down for the want of coal. The great shipyards of the Clyde are at a standstill and several lines of ocean steamers have ceased to run. There is great privation among the men, but they propose to win and will not compromise.

W. J. Rice, who has been chief clerk of the motive power department of the R. & D. at Marion, N. C., for the past five years, has been appointed chief clerk of the motive power department of the G., F. & S. at Macon, Ga.

Work on the Pike's Peak ladder road has been given up for the season, and the two little dromedary engines put under cover until spring.

Over forty million passengers went over the Brooklyn bridge last year. The fare is one cent to walk, and three cents to ride.

At the G. T. shops at Montreal they saw off flues with a circular saw, but they heat the tube red-hot first.

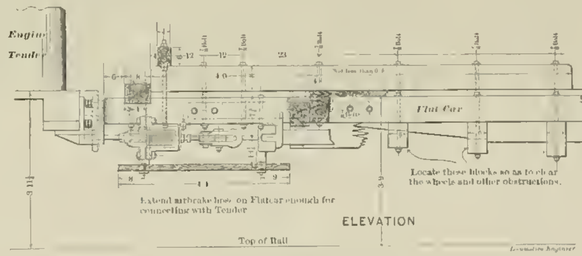
A Cheap Dynamometer Car.

The engravings shown herewith illustrate a very efficient and cheaply made dynamometer car, recently constructed on the A., T. & S. F., under Mr Player's instructions.

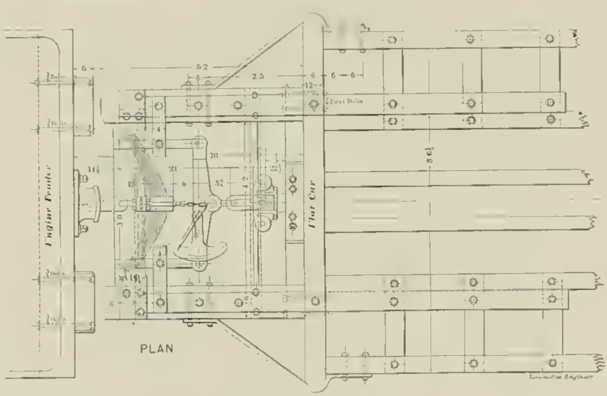
As will be seen, it is in the shape of an attachment to a flat car, and can be taken off when so desired. No particular description is necessary; the dynamometer is simply a huge spring balance, the spring used being a driving spring tested for depression. The spring is held in a harness as shown, and a lever multiplies the movement, and registers the amount of pull on the dial. This instrument works nicely in service, and its register agrees with the amount of work shown by the engine indicator, but as the indicator accounts for *all* the work done in moving a train — which includes overcoming the friction of the locomotive and tender —it gives the *gross* power required, while the dynamometer registers the *net* or effective power of the engine.

Engineers and other railroad men who have not studied very deeply into the science of their business are always surprised to find how little actual pull a locomotive can give at its draw-bar. An eight-wheeler 18x24 does exceptionally well when she exerts a pull of 12,000 pounds on her train.

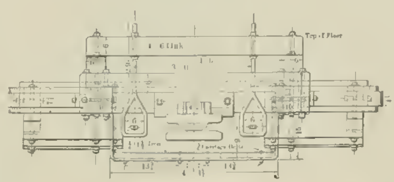
The dynamometer is the true way to test a locomotive's work, but offers no advice about remedying defects such as the indicator does—unless it be to point out the need of more adhesion.



ELEVATION



PLAN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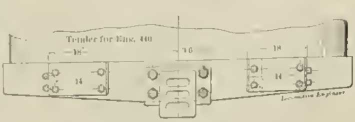


END VIEW OF TENDER
SHOWING LOCATION OF BUFFER BLOCKS.

We have received from Pedrick & Ayer, Philadelphia, a very handsome and elaborate catalogue of their milling machine, open side planer and cylinder boring bars; also a framed picture of their new shop. The catalogue is the best one we have seen this year, and the picture of the shop is as natural as life, but we do wish P. & A. would take that little P. & R. switch engine, shown in the foreground, into the shop and make a few changes. The axles are bent, whistle is on the sand-box, and the bell on dome, where pop ought to be, and there is no valve gear at all—it ought to be fixed soon, or the street car horses, waiting for it to pull a train off the crossing, will starve to death.

Talking to a manufacturer lately about the piece-work system, we asked him where he thought he saved by it. "Everywhere," he replied. "I was opposed to piece-work myself until this general foreman came to me. He wanted to introduce it, but I objected. He finally offered to take as his salary the time spent in water closets by the men or the machinists' time that was spent going to and from and waiting upon the tool dresser. This set me to thinking, and I put a boy to check up time spent in the closet by the men in the shop. They averaged about twenty minutes each per day—went there to loaf and smoke. I had 300 men then, and paid some of them four dollars; but at twenty-five cents per hour this time, which is 100 hours per day, amounts to $25 per day, or $650 per month of 26 days. That is all saved in the piece work plan."

In the Grand Trunk yard at Montreal we recently noticed a locomotive that had come in on one side on account of a broken piston. She had solid side rods, and when the main rod was taken down there was nothing to keep the side rod from slopping around over the whole length of the pin, and the engineer had sawed short blocks of wood and tied them around the pin on the main rod bearing. An old side rod bushing, carried in the tool-box, would be handy to slip on to the pin in a case of that kind, and would save time.

The Reading road have placed an order for 5,050 freight cars with the Pullman Co. They will cost $2,500,000, and be paid for on the installment plan. A big order.

The Interstate Commission has sent circulars to railroad officers and organizations of employes asking information on the treatment of employes. Among the points covered are: Insurance and guarantee funds, accommodations furnished the men when away from home, technical education in the shops, possibilities of promotion, and special rules as to the competency of trainmen.—*Ex.*

What the Interstate Commission want to be doing is to investigate, show up and demand a change in the hours that men are obliged to work on locomotives. Forty-eight hours of continuous duty is not uncommon, and twenty-four is a regular thing on many roads. This alone is the cause of many accidents, is a constant menace to life, and must be stopped.

The proprietor of the *National Car and Locomotive Builder* recently presented Editor Angus Sinclair with a gold watch. When Sinclair had that old penitentiary-escapement in a nickel case that he used to run engine with, he never wanted to compare time with us, and if a man asked him the time on the street he looked at the sun and guessed, but now it's different. A man with a new yellow watch always feels constrained to haul it out and look at it every four minutes, to be sure it's going and is there.

The Gt. Northern, formerly the St. P., M. & M., are building track from Fairhaven, Washington, toward Westminster, B. C., which, when done, will be known as the coast extension of the Gt. Northern. Engineer P. E. Adams was sent from the main line over the C. P. to Westminster, where the engine and one car were placed on a barge and towed to Fairhaven, on Puget Sound. Now she is slowly working her way out of the wilderness toward the British possessions.

It is getting to be a pretty regular thing to see accounts of locomotive boiler explosions. During the past month nearly a dozen have gone up. The Reading lost one of their Wooton's—blew up in the roundhouse in Philadelphia. The Lehigh Valley have recently lost two. D., L. & W. are "in it," as is also the Fitchburg, though not within the month. Boilers that have been in use on locomotives twenty years and more are not fit to carry high pressures. In a recent meeting of the M. M. Association, a well known superintendent of M. P. said that he had boilers that were covered with asbestos mortar that had not been removed in sixteen years. Some grand juries would make a road squirm on that, in case of an explosion. Better and more frequent examinations are needed on most roads.

Fireman Martin Conniff, of Louisville, Ky., recently fell from the headlight when cleaning, and was impaled upon a flag-staff on the pilot. He died in great agony. Look out for these traps, and don't tolerate any flag-staff with spears and battle axes on top to make them pretty.

The First Successful Screw Propeller.

The screw propeller was first proposed by Hooke, 1680, and between that time and 1835 many propositions to use, and several patents were issued, in different countries.

Col John Stevens, of Hoboken, N J, experimented with a screw in the North River as early as 1804

In 1836 Capt. John Ericsson and Francis P. Smith, of Hendon, England, brought out their screw propeller, and by their energy and ability forced it upon the attention of the world and proved its merits.

When Ericsson exhibited his little screw-propelled boat in the River Thames, in 1838 one of the interested spectators was Commodore Robert Stockton, of the United States Navy. At that time Commodore Stockton was at the head of the New Jersey canals, and thought he saw in the screw the future tow horse of America.

Before coming home Stockton ordered a boat that was to be seventy feet long and draw five feet of water This boat was built under Ericsson's direction, and came to America sloop rigged, in 1839, being the first iron hull to cross the Atlantic.

This boat had a double screw, one running on a hollow shaft, the second on a shaft extending through the tubular one, the wheels running in opposite directions. This plan called for complication in the engine, and endless trouble in many ways.

It was found that, instead of drawing five feet of water, the boat drew seven, and she would not go up the canals. This so disgusted Commodore Stockton that he had her name changed to "New Jersey"—she originally bore his name—and sent her to Philadelphia to tow canal boats from the Schuylkill around to the city front

The rudder was of iron, in two pieces, one above, the other below the double shaft, and was fastened to the stern post, the shafts passing through the connecting bars of the upper and lower pieces of the rudder, and the boat was, in consequence, very hard to steer, doing damage by running into other boats and the piers—for most of which the screw was blamed. She was so unmanageable that it was customary to tie her up to a wharf and let the tide turn her around.

After a year's service the boat was turned over to Mr Isaac Dripps, the superintendent of motive power of the Camden & Amboy (now Pennsylvania) road, with instructions to fix her so that something could be done with her

As she was designed expressly for towing, the engine was a powerful one, for a boat of her dimensions, having two cylinders, sixteen inches in diameter, and of eighteen-inch stroke Mr. Dripps therefore designed and built the single screw propeller, as shown in our engraving, which was made direct from a photograph of a small model made from the original drawings. There was no former practice to guide the designer of this screw, he discarded the double screw of Ericsson's design, and made a single one on his own ideas As will be seen, it had six blades, which were very wide at the circumference and narrow at the hub. Having sufficient engine power at his command, Mr. Dripps, for this reason, gave the blades as large a surface to act on the water as the form of screw would allow.

Believing that the action of the propeller would tend to crowd the water away or throw it out circumferentially, he cast a projecting rib on the front edge of each blade, as shown, to enable the screw to get a firmer hold upon the water.

The blades were cast separate from the hub, for the purpose of cheap renewal in case of breakage, and the ends were let into a recess in the hub and held against a flange by bolts. The pull of the blade in the water was against this rib without putting strain upon the bolts. There is no doubt that this screw was the first perfect single screw propeller (true screw) ever built in this or any other country.

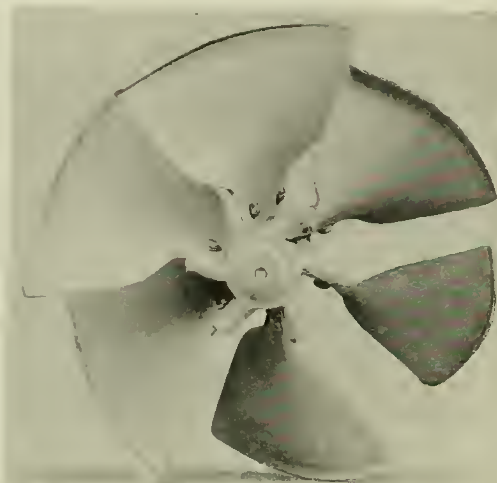
The rudder was placed behind the screw When these alterations were completed, and the boat tested, the new arrangements worked very satisfactorily The boat towed much stronger, ran faster, and the steering was perfect.

This boat and the screw were in use for many years in the harbors of New York and Philadelphia, and the wheel was only broken up at South Amboy, N J., a few years ago.

It is too bad that this specimen was not preserved in the National Museum, and it is equally fortunate that Mr. Dripps has kept his sketches and drawings all these years.

The editor of this paper is under obligations to Mr. Dripps for the use of the patterns, from which a very handsome model in brass was made for our museum by Fred H. Colvio, tool maker of the Rue Manufacturing Company, Philadelphia.

Isaac Dripps was the first man to handle the locomotive "John Bull" on her arrival in America He was the first American railway master mechanic, superintendent of one of the first locomotive works on the continent, and for many years at the head of the motive power department of the P., Ft. W & C., and the P. R. R. He was with the American locomotive from its birth up to its present efficient design, and had much to do with its ultimate individuality



THE FIRST SINGLE SCREW PROPELLER.

Though somewhat remarkable, yet to this same man should be conceded, and justly so, as shown above, the honor of designing and constructing the first successful single screw propeller—a device that has revolutionized the ocean carrying trade of the world—practically that now in use. He was not the first, it is true, to conceive the idea of such an instrument as a marine propeller, but in applying it in a simpler and more efficient form, and adapting it to operate *in front* of the rudder, he stripped the ideas previously conceived of it of some illusions, among them the belief that a single screw would list the boat, and, in view of what he accomplished, was the first to practically solve the problem of successful marine screw propulsion. His screw (designed for a tow-boat) had more blades, with more pitch, than modern practice, keeping step with modern improvements in engines and hulls, has occasion to use, but it was certainly a most splendid success as a first attempt, in practically solving the problem of screw propulsion, and one among many of the substantial improvements that should forever stand to the credit of the first American railroad master mechanic and that modest gentleman, Isaac Dripps.

Santa Fe Notes.

There used to be a tradition on the Santa Fe that course netting could not be used without setting fires, and that brick arches would not work—because they had been tried The new management of the motive power put in coarse netting at once, and opened the nozzles so as not to throw so much fire, before, the nozzles had to be pinched in order to force the gases and cinders through the fine netting. Brick arches seem to work all right now, too. By substituting inside clearance for inside lap the indicator shows a very large increase of power on the 19-inch cylinders

They have been getting up a new smoke-preventing device that has some novel features and will be covered with a patent. It is the well-known Clark jet, which is set in operation by the closing of the throttle; this action also applies the blower; when the engine is at work the admission of air is maintained by the suction of the exhaust; when shut off the jet starts automatically. It makes the engine smokeless at stations.

The Topeka shop has a large capacity, but the method of handling work is bad and the cost of repairs altogether too high—it has been pretty close to five cents per mile for repairs alone.

Mr Player is systematizing matters and getting more work done. Twenty to twenty-three engines rebuilt per month calls for lots of work, the men being pretty thick. Mr. Player is investigating the plan of piece-work, with a view to starting it in the shop, believing that he will do more work, can employ better men and pay them more wages. The piece-work plan pays each man for what he does, not what he is supposed to do. Engineers have to make their miles for their pay and can work little or much, as they feel; it is probable that machinists will have to do the same.

Mr. Player is also bettering the oil consumption. But ten miles per pint of lubricating oil was the average. This was not due to the engineers, who were anxious to do better, but to the want of any system whatever in the use of oil. The oil was not charged to the engineer, but to the engine, thus creating no individual sense of responsibility. Oil was as free as water, never locked up on an engine, which meant wiping and firing up with it. Two gallons per engine trip for tender-boxes alone was allowable. Mr. Player has indeed a big job on his hands, but he is the man for the emergency. The success he is having in his work is in no small measure due to the respect and friendship he inspires in his men He is honest and just and always has time to hear any one, be he a sup't, apprentice or a drummer.

Mr Player has done something very few new officials ever accomplished—got the good will of the men from the start. He sits down sudden and hard on unfair acts of officious underlings that makes the men respect him. The engineers already swear by him, and to a man seem anxious to help him further his plans in the development of better and more economical service.

The Strong is laid up and will be rebuilt into a compound. Constant leaks in the fire-box, caused by poor circulation, was her worst disease, but her valve motion developed enough lost motion, in a week's work, that an eighth of an inch lead was changed to one-sixteenth inch of blindness. When she goes out again she will be a 10 wheeled compound with plain fire-box and valve gear.

Greased Track.

"Speaking of grease," said the old-timer, as he dug a chunk of sausage out of his beard at our suggestion—"speaking of grease reminds me of a little gob of experience quite some time back in my wild career.

"I allus owned a crack ingine, crack for speed, steam, or something—have had 'em with cracked fire-box when I couldn't do better. Well, on the 'casion whereof I'm speaking I was sole owner of the 'Sebenteen,' and she was noted for shackling onto a row of freight cars and going to the other end of the division a little faster and slicker than anything else on the road, though there was plenty jest like her. When the 'Sebenteen' was new she had a cracked spider, which caused her to cut her left cylinder bad, and they bored a half inch out of 'em both before she were a week old, but, bless you, young man, that happened at the far end of the system, and nary a water biler but me knowed of it on our end, and I jist heard about it accidental like.

"The 'Sebenteen,' 'Eighteen,' and 'Nineteen' all came new together, was broke in and sent to us, and Bill Karr, John Dixson and me were in for 'em. Karr an' Dixson was older'n me, and had their pick, leaving me the 'Sebenteen.'

"Then to have her noted far and near for 'git' made 'em mad. I had a bragging conductor and a fireman that allus added 40 per cent. to every story he told of her speed or startin' power, but I naturally cling to the truth, bein' particular, however, to mention her virtues around where Karr and Dixson was.

"They declared I had monkeyed with the pops and falsified the gauge, and had the old man investigate—but I was honest. Then they settled down to saying the con. and dispatcher was in cahoots to down 'em by queering the register and train sheet, and believing it was all lie anyway.

"But one day all them three ingins was ordered out on three sections of 26—our regular merchandise train.

"The 'Sebenteen' was ahead, each scrap had 14 loads, and I knowed right away that it was to be a case of 'git thar,' every man doin' his darndest. To make matters worse, it was Sunday, and few trains on the line to bother us.

"I lit out first with red rags up for Karr, and his caboose was about thirty feet ahead of Dixson's mill.

"I got the 'Sebenteen' to making every turn in her before I dast to look back, but when I did Karr was there, and so was Dix. I dropped her down a notch, but she seemed to lose on it, and the fireboy was not keeping up with the stack. Then I hooked her back and tried to take the throttle lever out in the tank, but Karr whistled me ahead, and finally I got her in her regular notch with about half throttle—just where she could do her prettiest.

"The 'Sebenteen's' big cylinders would tell on the up-hill pulls, but she couldn't get to the foot any sooner than the other fellows—a stone will fall down a well.

"When I stopped for water they tooted their whistles to imitate a rooster. When I stopped half over the division for coal, Karr had to pull his ingine over to keep from hittin' my caboose, and both on 'em whistled fit to bust their bilers. The last half of the road was mostly up hill, and I counted on gettin' away from these fellers, but 25 miles were made with them within sight.

"After this we got ahead, gained steady, and Mike, the 'Sebenteen' and me were shakin' hands and yelling like konkerin' heroes.

"Ten miles from the terminal they were out of sight, and in five miles more we lost sight of their smoke.

"After gittin' in we got the engine turned, and Mike and me washed up and set down on the eatin'-house steps with a toothpick in our mugs, each tryin' to appear like he had been there a week or ten days.

"It was two hours before their trains got in, and when me and Mike saw Karr and Dixon coming we laffed fit to bust.

"Two madder men you never see. They dared me to come off the stoop while they licked me, said I was a 'nordinary low-down whelp to resort to such tricks to keep up the reputation of the worst old scrap on the road, &c., &c.

"I couldn't git a word in edgewais, and I don't know how much longer it would have been before I would have got licked—for either of 'em was bigger nor me—but just here we heard the darndest noise up in the yard—the pony was slippin' 80 mile an hour, krashed into some cars, come back, still a slippin', and run off a switch. We all run up there.

"Well, then it was soon explained—the track was greased!

"The last car on my train was loaded with oil in barrels. They was piled up three deep at each end, and one of 'em fell down, busted, and let the grease run through the doorin' onto the track, and so to the rails.

"Those follerin engines like to slipped their innards out when they struck it, and run out of sand in less than no time, had to stop and hunt ant-heaps and all that. Both Karr and Dixson thought I greased the track back of my ingine to do 'em up, and come near doin' me up for it.

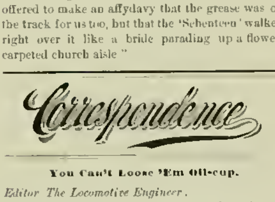
"But I got even with 'em. Mike and me both offered to make an affydavy that the grease was on the track for us too, but that the 'Sebenteen' walked right over it like a bride parading up a flower carpeted church aisle."

Correspondence

You Can't Loose 'Em Oil-cup.

Editor The Locomotive Engineer :

I send you a sketch relative to the fastening of rod-cups, as this is an item of importance in engine supplies—and a large one, if the immense pile of



crippled oil cups that are lying around any shop be any indication.

The great difficulty, as I see it, is that constant screwing up by the engineer, gradually pulls the stud down in the strap, and by slowly yielding to the immense strain separates the metal at the junction of the cup.

The plan I suggest would certainly obviate this, the idea may be old, but there is no possible reason why it would not effect the desired point; the tap screws should be of iron, and the whole may be fitted to either old or new straps. Of course, it is obvious that special shape may be given to the base, to conform to circular ends.

Denver, Col. L. C. SHARP.

Cabs.

Editor The Locomotive Engineer :

There are cabs and cabs. Just now I have got one that would make a good hen-coop or a grape arbor. Last summer, when it was ninety in the shade, I had a new engine with an air-tight sweat box on the back end of the boiler that ought to have been used in the blacksmith shop for an annealing-box. Our company are in season—hot cabs for hot weather, cold cabs for cold—why not? It beats thunder that I can't get locomotive builders, or at least our master mechanic, to see what is wanted in the cab line, and build cabs—not hen-coops or coffins. Cabs are supposed to be put on locomotives for the protection and comfort of the engineer and fireman, nothing else, and a little intelligent study will show that there is no need to attempt to imitate a house, a church or a corn-crib.

In the first place, every cab should be high enough, so that a man can stand up on the running board without ducking his head. The front ought to be air tight when closed, and means provided for ventilation and light, the latter to be admitted in the right place, and excluded at the wrong.

No front door or window ought to open *in*, or slide—you can't keep 'em tight if they do.

The front door should be hinged on front of cab nearest boiler, and swing from the corner *out*; this will admit air, and throw most of the cinders on the running board, and a rubber batten on the outside will keep it air-tight when a head wind strikes it—the inside opening door can never be kept tight. When it is partly open it throws all the cinders over on the man on the opposite side of the cab, and it is hard to get out of in an emergency. The front windows ought to be as large as possible, hinged at the top and swing out and up—less cinders and more air. The pressure of head wind will tend to tighten them, and they will not rattle.

There never ought to be glass in the front pane of the side of cab, a board panel is better; you can see ahead better at night with your head out side, as the dark panel does not allow light from the gauge lamp or fire door to shine in your face; if you have glass already, paint it over. The back side sash ought to be held open or shut by a stiff spring, to prevent wear and rattle.

Below the front door there should be a slide or small door to admit air, and the joint between the boiler and cab should be tight and the inaccessible corners filled with wooden blocks to facilitate cleaning out. In winter the reverse lever slot in deck should be covered with a slide—a wood or iron one may freeze fast, and a strong wind will lift a leather or rubber one, but one of the latter materials, with strips of iron on it crosswise, is tight, and will double up before it will be stopped by an obstruction at either end.

All these little things will make a cab comfortable and endurable, in cold weather and in warm. Some of the snow clearing devices shown by you are good things for the front cab door—and that reminds me. Once upon a time I was sent out on the west end to run snow plow—the superintendent was mad at me, and thought he would get me killed off.

It was one of those great, big, wedge plows built onto the front of the engine, and the habit it had of covering up the cab, inside and out, was partly its fault and partly the fault of the cab. I never go out snow plowing without having boards cut just the right size to board up any window, should one be broken.

With a wedge plow you want your front windows clear, as you dare not look out the side, but it is hard to get just what you want—especially on a snow plow.

A young Swede, named Dennis Murphy, was shoveling smoke for me, and Dennis, in his way, was a genius—he had more schemes of his own, that wouldn't work, on that engine than I had.

Dennis was happy on the plow—little firing and lots of excitement—but he had bored the front of the cab full of holes for all kinds of snow cleaners, and all were failures. Dennis got hold of one of those railroad papers that have so many nice kinks, devised by druggists and plumbers, for locomotives, and among other fool things read that item about putting in a double glass to the front door and filling the space with alcohol to prevent frost from forming—it's floating around yet (the item, I mean).

Well, Dennis worked four evenings and all one Sunday to get a joint between those double panes of glass, and Monday morning we started for Drift dom with the clear morning sun shining across the snow and through Dennis' half inch of alcohol.

An hour later Dennis was telling me how he'd make me a "whiskey door," as he called it, and, lighting his pipe with the torch, when a big chunk of crust knocked out both glasses and deluged Dennis' head with alcohol, which took fire from the torch with a loud "whiff."

Before I really got it through my head what had happened, the "Snow Bird" was up to her ears in a drift, and off the track, and Dennis crawled out from under a wagon load of snow that had him down on the deck, and commenced to fumble around for his coal pick, still holding the stem of his clay pipe between his teeth. When he found the pick he coolly proceeded to paralyze what was left of that front door.

Dennis looked like a singed cat, and was real mad at the paper for advising him to do such a fool thing, but it wasn't two weeks until he rigged up a pole-and-monkey movement that was to open the fire door, and slightly start the blower when the throttle was shut off—this was going to save coal, smoke and work, mostly work—but the pesky thing took off his thumb, somehow or other, and Dennis traded the "Snow Bird" for a dinky in the yard.

I wish that one of the fellows who are responsible for the kind of cabs we have was placed in his own room, the windows fixed just like cab windows, and the doors just like cab doors, and that room or that house was hurled through the air one good, stormy night, at the rate of forty-five miles per hour, with a wind going the other at the rate of fifty, and that fellow's whole skin depended on his paying particular attention to what was in front, regardless of frozen feet—I'll bet he wouldn't haggle a hole in the front of it for a reach rod that was big enough for the boiler. That's what I'll bet.

JOHN ALEXANDER.

The Air-pump Puzzle

Editor The Locomotive Engineer:

Relyea's question about crippled air-pump reminds me of the story of the marine engineer who, when asked what he would do if he had a pump that would not work after he had taken it down and found all the parts in good condition, replied that he would look over the side of the boat to see if the lake had dried up. Relyea's pump is all right, yet it won't work. After I had satisfied myself that there was really air for it to pump, I think I should see if it got any steam. But to the question: In the first place, we are to understand that the trouble was in the steam end; the main piston and rings were right, so were the reversing piston, main steam valve, reversing valve and all of its attachments. What was the trouble with the pump?

Mr. R. says that some might say that one piston or end was off of main steam valve, but I don't imagine that any one that understands the principle of the air-pump would have any such a thought. For if that happens you will never get another stroke out of the pump until it is replaced. Below will be found some of the causes for a pump acting as Mr. R. says this one did, that have come under my personal observation. First and most common is an ill-fitting reversing piston which will stick when in certain position, or a crooked reversing valve stem working all right until it happens to turn just right to come out of reversing valve plate, causing pump to stop until it was replaced, or an irregular shaped piece of iron like a reversing valve plate bolt head is in main cylinder, which will prevent the main piston from making a complete stroke with same effect as a bent valve stem, or a loose reversing valve bushing, that may turn sufficient to cut off the supply of steam from reversing valve, thus stopping the pump until replaced, which in that case might have been done when the cap was removed by machinist number one, or the little dowel pin that holds reversing cylinder in position might be out or broken off, permitting the cylinder to turn with the same effect as the reversing valve bushing. The machinist unwittingly turning it in proper position when he removed cap, or the little pin or stop that supports main steam valve when steam is shut off, being too short or broken off, allowing the valve to drop low enough for one of the packing rings to catch below the bushing, stopping its operation untill it was raised, which might have been done by machinist number one, but this latter case is not apt to be the trouble, for it sometimes happens that you cannot remove it without breaking it.

Mandan, N. D. C. E. N.

Editor The Locomotive Engineer:

In the December issue W. F. Relyea has a nut to crack on air-pumps. I am not an air-brake expert, but I want to take a whack at the nut—even if I do miss. I should say that the packing rings on main steam valve were too loose or broken, or that the post that stops main steam valve on its downward stroke at bottom of cylinder had become worn off, and let steam valve travel too far, thereby causing rings to catch on bottom of bushings wherein they work, consequently could not make its upward stroke. If I am right or wrong let us know the trouble. READY.

Clinton, Iowa.

Editor The Locomotive Engineer:

I think it possible that in Relyea's pump something got into one of the ports, or his reversing valve rod was bent and worked around and got out of place. What surprises me most is that he was able to get the top head off and piston out to examine rings and put them back and got the pump in shape to run in twenty minutes. EDWARD GIBSON.

Wilmington, Del.

Editor The Locomotive Engineer:

In the December issue I saw the air-pump puzzle by W. F Relyea. I should say that he probably found the third piston broken (the one that works in cavity above main steam valve). The engine that I am firing had a pump that acted the same as this one. On examination we found the third piston broken where rod screwed into the head; we replaced the broken parts, and pump worked all right balance of the trip, when a new valve was put in. SANTA FE FIREMAN.

Mulvane, Kan.

[The third piston spoken of by our correspondent is known as the "reversing piston," which Mr. Relyea stated was all right.]

The Answer.

Editor The Locomotive Engineer:

I presume, or at least I hope some one will answer my problem in last month's paper about the air pump on engine 434, and while somebody is preparing an answer for the next issue, I will tell them all about the difficulty, in the same paper

It was this: The main steam valve stop broke off, and let the valve drop through the bushes; now I think I hear some one say, if the main steam valve got through the bushes, the bottom ring of each end of the valve must have expanded enough to catch the lower edge of the bushes and hold the valve so it could not move; if that was so, how could the pump stop for a while and then go to work again? Well, I will tell you. When I put new main steam valve bushes in, I always round out the bottom of the bushes, so that if the stop should break off, I can pull out the valve easy; now this pump I speak of worked while the rings kept control, but after a while one end of the bottom ring, which was worn very thin, got out and caught between the bush and lower end of valve, and held it there, and then she stopped My way of putting in stops is this: With a long punch I drive out the piece left in the center piece, then taper the point of the new stop so it will enter the hole easy, then with a long pair of tongs put it down through the bushes and into the hole, then with a long punch, with one end turned to fit lower bush, I drive the stop down, all of which can be done in less than twenty minutes, if everything goes right.

Syracuse, N. Y. W. F. RELYEA.

Do You Miss Your Paper in this Way?

Editor The Locomotive Engineer:

I have a question, relative not so much to the running and management of the locomotive as to the regular distribution of THE LOCOMOTIVE ENGINEER. It is this:

Is the U. S. Post Office Department supposed to deliver periodicals to subscribers who do not have boxes, unless the subscriber calls specially for a paper or magazine, as the case may be? From observation I am led to believe that a great many people understand that when they ask for their mail it will be delivered to them, if there is any to their address in the office, whether it be letters or periodicals. That it is the practice in the offices to examine the letter files only when patrons apply for their mail, accounts for the non-delivery of a good many publications. A. H. TUCKER.

Chillicothe, Mo.

Data Wanted.

Editor The Locomotive Engineer:

Having been a link in a chain-gang for a year, I am somewhat interested in learning all there is to be said for—I know enough against—the system of pooling engines. Will George H. Brown, or some one else in position to do so, give average mileage, and cost of keeping up and running pooled engines?

Galesburg, Ill. CURIOSITY.

[We want "Curiosity" to tell us the disadvantages of the chain-gang system—this is no one-sided affair.]

Two New Air-pump Problems

Editor The Locomotive Engineer:

I want to give the boys a couple of air-pump puzzles

First case: Pump would run all right for five minutes, then stop, starting again of its own accord in ten to fifteen minutes, and stop again in five. On examination, all valves and the reversing valve rod, and all the ports were in first-class order. Machinist fixed it in twenty minutes. What did he do?

Second case. Pump would not raise more than thirty pounds of air, it was taken off the engine and to the shop. Nothing was done to it in the way of repairs, it was set up and tested, and would pump more air than it had steam to drive it. With sixty pounds of steam it would pump seventy five of air. All the pipes on the engine and the pump governor were all right. What was the matter? EDWARD GIBSON.

Wilmington, Del.

Stroke of Driver Brake Pistons.

Editor The Locomotive Engineer:

In the September number of your paper, in the column "Asked and Answered," Question Number 55, C. B. N., Galena, Ill., asks: Why does an engine's driver brakes hold better when the piston has less travel? *A*.—Other things being equal, the length of stroke will make no difference with the retarding power of the brakes.

Now this answer will do in some cases, where straight air (or non automatic) is used, but it will not do where the automatic brake is meant. To be sure, the same area or piston surface is exposed to pressure, which forces the piston either way, whichever it travels, no matter how far the travel may be, or how little. And were the air pressure the same, of course the answer would be right.

The cams have curved faces and are so arranged that a constant pressure is brought to bear against the brake blocks at all parts of the stroke. But when we use the automatic brake, the farther the brakes travel the more the air expands, which, of course, reduces the pressure, retarding the power of the brake in proportion to the distance traveled by the piston.

For example, we will say, as all versed in air-brake practice know, that the air is stored in an auxiliary reservoir, and when the brakes are applied the air is decreased in pressure by being brought in communication with the two driver brake cylinders, and no more air being allowed to get in the reservoir while the brake is on, the body or volume of air is expanded into space equal to the space in reservoir, plus the two spaces in the cylinders and pipe connecting cylinders, so you will readily see that the further the pistons travel the more the air is expanded, thereby reducing the pressure on the brakes, preventing them from holding as tight as they would were the travel less.

I contend that this subject should be well studied by all having the management or handling of air-brakes, and I think your paper is doing splendid work among those who take interest enough to read these different questions and answers in its columns from time to time. FRED. B. ARMSTRONG.

Camden, N. J.

[Our correspondent is right about the expansion of air in automatic brakes, but our questioner wanted to know if the length of stroke made a difference, other things being equal, and we answered no. With steam brakes the stroke makes no difference.]

Those Breakdown Nuts.

Editor The Locomotive Engineer:

I have seen an 8-wheeler come in without back drivers, as De Sanno describes, by simply chaining back end of frame to the tank and running slow.

To his third question I should say that there was a hole in the wall between steam pipe and exhaust cavity in cylinder casting JOHN ORTON.

E. St. Louis, Ill.

Making Tools of Air-pump Valve Stems.

Editor The Locomotive Engineer:

I take a reversing valve stem and cut off the button at the lower end and cut it in two between the shoulders in valve fit, draw out the top for a handle shank and the bottom into a screw-driver bit and make a round handle of apple wood and ferrule of brass pipe. If you take a valve stem that has been in use for a year you can hammer out the point and shank cold. The longer these valve stems run in steam the more pliable they become. Small taps and reamers can be made of them also.

Syracuse, N. Y. W. F. RELYEA.

[Bro. Relyea's screw-driver would be a good one, but it would cost somebody about twice what a good one could be bought for.]

The Traveling Engineer.

Editor The Locomotive Engineer:

It is nothing unusual to see notices each month in the railway publications that some traveling engineer has been promoted to division master mechanic. There is no reason why a M. M. who has passed through the various grades of machinist, fireman, engineer and road foreman of engines will not make a better M. M., for both the company and employes, than one who has not had that line of experience. It is, therefore, in the interest of the enginemen to give the T. E. a cordial reception and all the assistance possible. Some of the enginemen are apt to look on him as a petty official who is going up and down the road trying to catch them doing something wrong and getting them punished for it promptly. If he appears at a station unexpectedly, they seem to think he has a grudge against them in particular. If a man is appointed T. E. who thinks it necessary to do much detective work, except for the protection of the good industrious men against the carelessness or incompetence of the bad ones, he is out of his place. Such a man will soon hang himself, if given rope enough. No honorable, upright man will stoop to dishonorable practices because he holds a subordinate official position; the sense of his responsibility will tend to make him just. But the man who is able to attend to his business, and does it at all times, is not afraid of meeting any of the officials at any time. The careful and conscientious engineman finds that the services of an intelligent T. E. are of value to him at all times. He finds that his co-operation is assured in any move to better the condition of the men and the machinery. It is a selfish view, perhaps, but enginemen should favor the T. E. for another reason: it is to his direct interest to have one who has had an engineer's trials to contend with, as master mechanic, rather than a man who has come up to his position through the grades of the repair shop. A shop man does not always see the necessity of material and devices absolutely indispensable on the road to the engineer, if he has authority to say they can't have it, they don't get it.

There is one branch of railroad practice in which the T. E. is absolutely necessary—instruction in the operation and care of the automatic brake. There is a big army of men who handle it and look after its maintenance in the best order, as far as they are able. Among them are thousands of bright, progressive men who are always ready to learn, and from anybody that knows about it. No one can post them up so well as the T. E., if he knows about it himself and has the proper appliances for doing it, thus settling all the vexatious questions that come up, by an object lesson with the brakes themselves. Many a man has wrong ideas about the matter, some have none at all, as is found out when there is an accident. The value of a first-class instructor in air-brake practice is acknowledged by all.

Where engines are double crewed, or, what is worse, "chain ganged," there is lots of work for the T. E., who can put in all his time with the engines while in service. Double crews on engines are getting to be quite the fashion nowadays, for it is possible for an engine to make more miles a month than a man can stand. Every man cannot be his own T. E. then, for it is every man for himself and get all you can. Engines have hard enough service where each man has a regular one, but with everybody wearing them out and no time to repair them properly, engines don't always get a fair show out on the road.

This article is the result of observation on roads with traveling engineers in service, on roads without any and on roads which have adopted the plan recently. Some of the M. M.'s say it is a good plan and makes their duties much less arduous, others are non-committal. Most of the employes believe it to be a good thing for the companies and engines, but there is a difference of opinion as to the advantages for the men. As for myself, I must confess that it is a matter of observation only, not of actual experience. CLINTON B. CONGER.

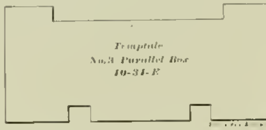
Lansing, Mich.

Rod Brass Template.

Editor The Locomotive Engineer:

Herewith find drawing of template used for rod brasses in the Boston & Albany shops. It is a cheap and handy thing for the planer man to hang on his cupboard door. It is made of ⅛-inch steel, and has all dimensions of the brass.

The length and width is the size of section of stub end or back of box. The upper or large notch is the length of half the box, the two lower notches fit over the flanges, giving the distance apart, and thickness of same. When a brass box



is planed from this template it goes into the strap without any filing.

The template for each sized brass is marked as per cut, in this case it is for the No. 3 side rod brass of our Baldwin consolidation engines with 20-inch cylinders as shown by the Baldwin symbol 10-34-E.

E. Albany, N. Y. MECHANIC.

That Pot-bellied Exhaust Pipe.

Editor The Locomotive Engineer:

In a recent number of your paper I saw a reference to Mr. McCrum's "pot bellied" exhaust, in which the writer expressed a belief that an indicator would show back pressure to pay for what advantage the pipe might have.

In mechanics, facts are what tell, and here are the facts about this "pot-bellied" exhaust pipe. It has about two and one-half times the internal capacity that an ordinary pipe has; it gives a soft, steady blast on the fire, throws little fire, burns less fuel than the common pipe, and runs with larger opening than any common pipe can. Our 16x24 inch cylinders use a 4 inch nozzle; 17x24 use a 4¼; 18x24 use a 4½ to 4¾, pretty large sizes.

Our 16x24 engines have steam ports 1¼"x14", equal to 15¾ square inches, a 4" nozzle gives about 12 square inches—not much back pressure there. The area of the "pot-bellied" pipe is, at the center, about three and a half times the area of the exhaust opening in the saddle, and patterns are now in the shop that will give us a "pot belly" five to one. Come and see us, look in the fronts, ride on the engines, test, if you want to, and you will see the advantages of the expansion, or "pot-bellied" pipe. H. KINGSLAND.

Kansas City, Mo.

About the Compound on B. & O.

Editor The Locomotive Engineer:

While reading the December LOCOMOTIVE ENGINEER, I saw an inquiry from W. de Sanno about the Baltimore & Ohio compound locomotive, and feeling that all curiosity should be satisfied when it is convenient, will try to assist you in the matter of enlightening his mind a little on that subject, by stating what I found out concerning that engine.

After looking around Philadelphia, and attending to some business matters the other day, I still had some time on my hands, and "thinks I to myself" I'll go to the B. & O. shop out at 58th street, and see the "compound engine."

She was in for repairs, had bent a piston rod in one of the large cylinders, and broken cylinder head; the pistons were all out and the large cylinders were cut so badly that they were going to rebore them, the valve covers were off, and one valve out, which showed a very little wear had taken place on them.

I learned that this engine was now using same size nozzles as the other engines. Also that it did not do as well as the regular engines. Was informed that the B. & O. was having some new engines built at Baldwins' locomotive works, but they were not to be of the compound type.

One was apt to form the impression, from what could be learned around there amongst the engineers and shop men, that one compound engine was enough for any road. None wished to say much about it in any way, but were very willing to entertain one on any subject, except when the compound was referred to, which appeared to throw a chill on the conversation at once. I was not able to learn why they used larger nozzles on the compound during the test than they do now—in fact, there were a good many things that were hard to find out about that engine; why the piston bent was a mystery only to one not skilled in the arts. R. W. CAMEL.

Baltimore, Md.

De Sanno's Puzzles.

Editor The Locomotive Engineer:

There have been a great many questions asked and answered in regard to what to do in case of a breakdown on the road, but I think that Bro. W. De Sanno has got his graft in on some of the boys this time. For my part, in the first case, I would take down both side rods, load them on the back end of tank, then jack up back end of engine high enough to slip a pair of old pony truck wheels under the back pedestal braces, block up on top of the pony axle-boxes high enough so that the engine will set level when she is let down on the blocks. With a pinch bar pry up the back ends of both spring equalizers as high as they will stand and block them, fasten all blocks securely and let engine down; she will now run to the shop by careful handling. If this happened on the road where a man could not get a pair of old pony truck wheels I would take down both side rods, jack up engine until she was about three inches higher than I wanted her to run, block her, take out my jacks, place them under the tank back of the front truck, take down my feed pipe hangers on both sides, uncouple both hose from feed pipes, take out center pin of front truck under tank, jack up tank till the truck is clear, run truck up in under footboard of engine as far as she will go, put a block on center casting of truck, thick enough to hold back end of engine up level, take two rails, long enough to reach from the bolster of the truck under the footboard through under the tank onto the bolster of the back truck, fasten one on each side near the wheels securely, if it needs it, put a piece of plank across the rails under the front of the tank to hold it up level with the footboard, let tank down on the rails, block back ends of equalizers and let engine down on the truck, put up feed pipe hangers, couple hose, and run carefully to shop.

Second. The dry pipe was not collapsed, the throttle was disconnected, and when you shoved in the throttle lever it cocked the throttle valve so she got a full head of steam, as soon as the valve worked loose and dropped into place it shut off steam. This happened with me once.

Third. In answer to this one, I think one of the bridges between the steam ports and the exhaust port was broken, or the valve was jammed in the yoke so it held it cocked up off the seat and allowed the steam to blow through.

El Paso, Texas. FRANK PHELPS.

In Pedrick & Ayer's shop, at Philadelphia, they have rigged up some very ingenious devices for moving heavy face plates, or tables, on their long Richards planers. In scraping the traveling carriage to a fit it is a job to move it along the bed by main force. They hitch it to an iron link belt running over sprocket wheels, between two posts in the shop, there is a simple reversing motion, so that it can be moved backward and forward. When not in use the chain is thrown off the wheels, the device thus occupying no room when out of use. It is driven by a rope belt.

The Priest snow flanger, one of the best extant, is meeting with approval in the Northwest, where the trials are severe. A partnership has recently been formed between Mr. Priest and W. E. Haskell, of Minneapolis, and the introduction of the device will be pushed.

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The Pool System of Running Locomotives.

Within the past twenty years there has been considerable improvement in locomotive engines; no radical changes of moment, but a gradual perfecting of the machine in detail, until its efficiency has been nearly doubled.

Now, if anywhere in this broad land an engineer or a master mechanic believed and said that the old engines were the best, he would be at once set down as a back number, a man without judgment, and not a good one to have his say about a railroad or its power. Improvement is the order of the day; better service must be got out of our engines and rolling stock to please the public, and more interest must be earned on money invested to please the stockholder.

There is just as much chance to improve conditions, to earn more money or give better service by changing the mode of running engines or trains as in changing the engines or trains themselves. Why not? There are hundreds of master mechanics and thousands of engineers crying down and fighting against changes in running locomotives longer or harder than one man can stand to follow them. And every one of them stand in the way of improvement, and must either let loose and get into the current and go with it, or be swept into an eddy of dead water. They might just as well stand out for a return to wood as fuel or wrought-iron for tires. There are still many who believe that an engine gets tired, just as a man does, and needs as much rest. We have always noticed that a clean fire and fresh men seem to revive a tired engine wonderfully.

Especially in freight service is there room to increase, if not to double, the earning power of the locomotives by the plan of pooling.

Chain-ganging locomotives has its disadvantages, and as at present managed is fraught with tribulations and discomforts to the enginemen; but would it not be as well to use the energy now exerted to condemn the system, to improve the details and lubricate its rough bearings? Can't it be made endurable and far pleasanter for the men?

There is no use trying to kill the plan; it will live—because it pays the owners.

Let us suppose a case. We will say that a railroad—the P. R. R., for instance—has two thousand locomotives, two thousand engineers and two thousand firemen. Each engineer, fireman and locomotive work ten hours per day. Now, what difference would it make to the enginemen or to the company to double-crew all engines used?

There would have to be as many miles made as ever, therefore the number of men employed would be the same, they would have more regular hours of rest, but would not have their own regular pet engine. Financially it would make no difference. Let's see how the company would come out.

If they double-crewed the engines, each engine could give twenty hours of service and have the other four for running repairs. This would call for but half the locomotives. Two thousand engines are worth, at eight thousand dollars each, the sum of sixteen million dollars. The interest alone on this investment would be, at five per cent., eight thousand dollars per year. On one thousand engines it would be but four thousand, and this would release eight million invested in other engines, and this eight million dollars would earn four thousand dollars per year interest. The taxes on power would be cut in two in the middle again. The roundhouse facilities need not be as large, hundreds of tons of fuel now used to keep housed engines alive or to fire them up would be saved every year.

Engines would require more repairs, but not double the amount, as boiler and tank repairs are less per mile when engines are used continuously. Engines would earn double the money per year, but would last but half as long; this would be a good thing, for roads would not be stocked with power over ten years old, and would be able to own the best.

Of course there are details of expense against and some in favor of the plan—extra engines must be kept in steam at terminals to take place of cripples, etc.—but it is plain to any one who thinks for a moment that there are great advantages to a road in the plan. We cannot expect railroad managers to run roads to suit the notions of the master mechanic or the convenience of the enginemen. Every one ought to take hold in the right spirit to accomplish the most work with the least investment and at the least expense.

Master mechanics who oppose every improvement in the handling of their department are fast finding the handling of their men and engines on the road taken away from them. Engineers who oppose changes in running stand in the way. It must come. Don't get in the road and say "you can't do it"—they will go over you.

Let's study the problem, and fight now for every detail that will add to the safety, comfort and usefulness of locomotive engineers.

The system of blank reports of condition of engine when turned over by one man to the next needs elaborating and simplifying. The duties of inspectors need be clearly defined. Oil and fuel will have to be charged to men, not engines. Some scheme needs devising whereby you can have your clothes-box, oil cans, etc., put on the engine and taken off at end of your run. You will do no running repair work, the fireman will do no cleaning, and there will be other things to let alone that you are used to doing, and some to do that do not now belong to you. Try and get these details settled on a good, fair basis when the chain-gang system strikes your road—for it won't miss many.

It is rather curious that almost to a man railroad managers or presidents are for a consolidation of interests, for rate agreements, and combinations of roads to better the conditions of the road they represent, suppress strife and maintain rates, and yet are so eloquent against a consolidation of the organized employes of the roads. They tell the engineers that to federate means the loss of prestige of their order and makes them no better than trainmen or firemen, and they tell the other boys that with federation the engineers would dominate and control them. What is sauce for the goose is sauce for the gander. Federation goes just as far toward insuring peace and prosperity for men as for roads—in union there is strength.

When you think you are being unfairly treated by your officers or associates, before you kick very hard just think the matter over and see if you are entirely in the right yourself. Put yourself in the other fellow's place and take a fair, honest look at the case. Remember that this world would be pretty nearly free from wrong if each individual did right. Be fair. Sometimes justice cannot fly because she is weighed down by the leaden wing of selfishness.

Books Received.

VALVE GEARS. By H. W. Spangler, P. A. Engr., U. S. N. Whitney Professor of Mechanical Engineering, University of Pennsylvania. John Wiley & Sons, publishers, New York. Price, $2.50.

This work is an analysis of the Zeuner Diagram, and a general treatise on laying out valve motion of all descriptions. It was written with a special view to teaching the principles of valve motion, and is as complete yet concise a work of the kind as has come to our notice. The work contains nearly 200 pages, and over 100 engravings. It is especially valuable to those designing valve gear, and as a text-book in engineering schools.

MECHANICS OF ENGINEERING AND OF MACHINERY. Being Vol. III., Part I., Section 2. Treating the Mechanics of the Machinery of Transmission. By Gustav Herrmann, Professor at the Royal Polytechnic School, Aachen, Germany. Translated by J. F. Klein, D. E., Professor of Mechanical Engineering, Lehigh University, Bethlehem, Pa. Published by John Wiley & Sons, New York. Price, $5.

This work is one of a series of the highest grades of technical works published in America. This volume alone contains above four hundred illustrations on this particular subject. The works of this series are very exhaustive and complete, and necessarily employ the higher mathematics, and are considered the ablest efforts of a great German mathematician and engineer, whose works are an authority in many of the greatest technical schools in the world.

CATECHISM OF THE LOCOMOTIVE. By Matthias N. Forney, M. E. Published by the *Railroad Gazette*, and sold by Frederick Keppy, scientific book publisher, Bridgeport, Conn. Price, $3.50.

This is the second, and enlarged and revised edition of Forney's well-known book, the original edition having had a larger sale than any other work on the locomotive.

The author has culled out the least desirable parts of the old work, and added complete new chapters on Force and Motion; Resolution of Motion and Forces; The Principles of the Lever; The Action of the Piston, Connecting Rod and Crank; Action of the Pistons, Cranks and Driving Wheels; The Westinghouse Air-brake; The Care and Use of Air-brakes, and The Eames Vacuum Driving-wheel Brake.

The cuts are almost entirely new, and the plates are smaller and better arranged than in the original work.

Forney is one of the ablest mechanical engineers in the railroad line, and his writings are especially plain and clear. This work treats, in an elementary way, of the construction of the locomotive, tells how each part is made, and why it is made as it is, and gives rules for figuring out all practical questions concerning the "why and the wherefore" of locomotive service. No railroad mechanic, locomotive engineer or fireman should be without this work; it is almost all about the engine, and not so much about running or firing. The book is worth double its price to any man who has to do with locomotives in any way. It contains over 700 pages, considerably larger than the original work.

THE MECHANIC'S COMPLETE LIBRARY OF MODERN RULES, FACTS, PROCESSES, Etc. Compiled by Thos F Edison, A. M , and Chas J Westinghouse. Laird & Lee, Chicago, publishers Price, $1.

This work is a collection of a little of everything that a man who was not a mechanic might imagine would interest mechanics. It contains a great variety of reading matter, good, bad and indifferent, mostly the latter.

To begin with, a mechanic's complete library, or "five books in one," as this is called, is just like a patent medicine, warranted to cure everything from cancer to homesickness—it's a big job. While the names of the compilers may be all right, it looks like an attempt to use the reputation of two of America's greatest engineers, Edison and Westinghouse. Be that as it may, the book is bad, it contains so much misinformation. It would be a misfortune to any young man to read and place confidence in this work, because it teaches so much that is not true of mechanics that must be discarded and learned again, or forever hang like a millstone about his neck.

Of course in so large a collection of matter there is some good to be found; it would be almost impossible to get a book full of bad things The compilers seem to have clipped everything without being able to judge of its merits, or to even take time to eliminate references to illustrations that were in the original descriptions and are not in the book. The simple rule for figuring the safety valve is wrong. The description of the air-brake is horribly garbled. Repetitions are numerous They have collected some of those queer statements, such as a way to prove that the earth revolves, by the use of a dish of water—long ago proven untrue There is a list of things that "will never be settled," including, which side of a belt to run next the pulley, the right way to lace belts, whether water wheels run faster at night than in the day, the principle of the injector, etc., all of which are no more mysterious to a mechanic than the reason that fire burns They use a daily paper item about the Shaw locomotive burning gas (when used as a stationary engine) and state that with large machines for mixing gas and air, mounted on a car, gas can be used on locomotives. This is as useful information as it would be to say that it is believed that, with large reflectors mounted on cars, the rays of the sun can be so concentrated upon the locomotive boiler as to do away with the use of coal Here is a specimen item of information (?)

"A pound of tenpenny cut nails will do as much work as two pounds of wire nails. Taking the average of all cut nails, they are worth nearly double as much as wire nails, from tests make at the Watertown Government Arsenal."

There are already too many cure-all mechanical books on the market and not enough good ones, and we believe that we do ourselves credit, our readers a favor, and save them money when we tell them the truth about this latest collection of everything, apparently made only to sell.

ASKED & ANSWERED

(1) E. D. C., ———, asks.

At what temperature (Fah.) does water boil, at Leadville, Col.? *A.*—About 194° F. Leadville is 10.025 feet above the sea At sea level water boils at 212°, and will boil at one degree less for each 550 feet of elevation.

(2) New Subscriber, Paterson, N. J., asks:

What is the cheapest and quickest method of removing oil from nuts and bolts as they come from the threading machine? *A.*—The best known practice is to remove the grease in a bath of hot lye or caustic soda, drying them, while hot, in sawdust.

(3) Inquirer, Tulare, Cal., asks:

Will you please inform me through your paper what causes the short blow of air from valve when brakes are released with Westinghouse equalizing discharge valve? *A.*—We do not understand your question. Do you mean a blow of air from the engineer's valve? If so, from which port?

(4) J. A. N., Ayer, Mass , asks

Why will a lantern in the cab go out when the whistle is blown? *A.*—This only happens under favorable conditions, and is caused by a lack of air to supply the flame. If the cab is closed up so that the air coming to it is removed by the blast of the whistle, the effect will be more apparent. Anything that causes a partial vacuum in the cab will tend to choke the lights

(5) L F. W , Indianapolis, Ind., asks.

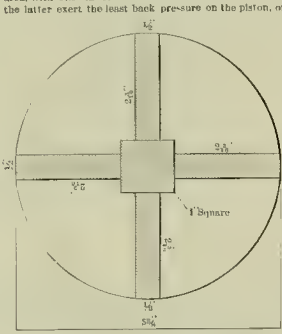
Why, in the Westinghouse quick action triple-valve, is the quick-action piston not made rigid, or solid, with the rod it operates? 2. Also, in the New York air-brake, after the release from emergency stop, where does the pressure reduce to which has forced down the quick-action piston? A.—1. To admit the emergency valve stem to the guide on the seat. 2 Into the brake cylinder.

(6) B. C. R., ———, asks:

Please give a brief description of the so-called bicycle railroad which was built and is in operation in New York? What power is used to propel it? How fast does it run? *A.*—The Boynton bicycle locomotive was designed to run on a single rail below and a guide rail overhead It is a steam locomotive, with an 8-foot wheel directly under the boiler, the top running into a slot formed in the bottom of cylinder part of boiler. The cab and cars are two stories high There is only a short line at Coney Island, but the engine shows that it is capable of high speed—the inventor claims 120 miles per hour—but that remains to be seen. It is a novelty, that is all.

(7) Frisco Line, Monett, Mo., asks:

The area of a 4½" single nozzle is 15.901 square inches, circumference in contact with exhaust steam is 13 13" Now, if I bridge a 5¾" nozzle to 18½ square inches in area, with 34.8" in contact with the exhaust steam, will the latter exert the least back pressure on the piston, or



will the additional surface counteract the increased opening? *A* —The increased area on your bridges will be so short that the friction of the steam in passing through will be very little. If the two nozzles had the same area of opening, the bridged one would produce a slightly greater back pressure, but with nearly three inches of area in favor of the bridged nozzle, there is no doubt that it would show the least back pressure of the two.

(8) H. S. R., Yonkers, N. Y , asks:

1 What do four whistles mean? What do two whistles, followed by two short whistles, mean? 2. What are the two green flags carried on the rear end of a passenger train for, which I see very often? 3. What does the sign (") mean? 4. If a young man wished to become an engineer on a locomotive, would he not have to serve his time in a machine shop first? If not, what is the very first thing he would have to do after having received a common education? *A.*—1. Whistle signals differ on different roads The standard code is used on most roads, however. Four whistles is a call for switchman, or a call for trainman out flagging. Four whistles, two short and two long, is often used as a highway crossing signal. 2 Green flags on rear of trains are markers that tell the engineer that his whole train is following 3. The sign " means inches, the sign ' feet—thus, 3'3"=three feet and three inches. 4. Get to firing; take any subordinate position to put you on the firemen's list.

(9) J. H. R , Huntington, Ind., asks:

Please tell me how to determine when the cylinder packing is blowing, and also tell when the valves are blowing and how to determine which side, without opening the front door of smoke arch. I have often heard my engineer say the valves were blowing. I could not see any difference between the valves blowing than when he said the packing was blowing. *A.*—When the valves blow, the sound of escaping steam to the exhaust nozzle is more nearly continuous than it is when packing blows, especially when links are hooked up. By moving engine slowly you can tell on which side packing blows, as when one side is using steam the other is not To be sure a valve blows, place the suspected side on or about the center, put reverse lever in corner notch, open cylinder cocks, and give engine a little steam If steam shows at cylinder cocks, the joint between valve and seat is not tight. If you place and block the engine so that the piston of the suspected side is in the center of the cylinder, put the reverse lever in the corner and open cylinder cocks, and give her steam. A strong blow will take place from the cock in the end taking steam If any steam appears at the other cock, the piston packing is not tight There are half a dozen ways to hunt for blows, think about them and reason them out Once you get the difference in sound between these blows in your head, you will be able to tell them by the sound alone.

Canadian Pacific Shops, Montreal.

[Editorial Correspondence.]

The Canadian Pacific Railroad is one of the wonders of this decade, and is a magnificent monument to engineering skill and human perseverance, showing what men can do in a short time when backed by money and with brains.

This company was not chartered until 1881, yet it has in operation 5,186 miles of road, only 1,257 of which are leased, and less than 1,500 were acquired by purchase. The line reaches from Quebec on the Atlantic tide-waters to Vancouver on the Pacific, over 3,000 miles Two thousand miles and over of this road was built across the barren wastes and the northern ranges of the Rocky Mountains in less than five years.

The road enjoys great privileges and has authority to operate telegraph and express lines as well as lake and ocean steamers.

It is the great rival of all the Pacific roads for through trade between the east and west.

There are in service 413 locomotives and over 12,000 cars. They have large shops at several cities on the line of the road, but the main shops at Montreal are the most extensive.

This shop was established here in 1882 and is a complete English shop, the original plant having all been imported Last year new car shops were built in another part of the city and the old car shop given up to the use of the mechanical department

THE ERECTING SHOP

is a long brick building, well lighted , it is high, having a gallery on one side where all the light tools are located. The shop has long tracks down one half of its width ; the other half is occupied by the heavier tools.

Over the pit shop heavy traveling cranes are located, capable of lifting a locomotive bodily. These cranes are rope-driven, almost noiseless, and very fast. They were built by the Cravens, Manchester, England.

A HANDY TRAVELER.

Right through the half of the shop occupied by machine tools there is an aisle some six or eight feet wide ; down this aisle there is laid a single rail; over this rail, on the iron framing above, there are two girders running the length of the shop. A crane is built on two wheels, one ahead of the other, the mast of the crane extending up between the girders, on which the crane load comes by rollers bearing against them. This crane is driven by a rope overhead, and has a seat for the operator, who, by handling one wheel, like a brake wheel, can cause the crane to travel in either direction or stop, and by using another wheel he can hoist or lower a load on the arm of the crane or swing it where wanted This crane can serve any tool within some fifteen feet of the track on either side, occupies but two feet of space itself, and will thus go in between work where an ordinary locomotive crane could not get. This little crane is neat, simple and cheap, does away with the desirability for individual cranes over such tools as heavy planers, etc. It is capable of lifting a pair of cylinders or frames and can handle a large amount of work.

There are several new American tools to be seen, but most of them are English ; some looked to me, awkward and complicated, while others looked exceedingly simple.

CYLINDER BORER.

One of the latter was a cylinder borer reduced to the smallest number of pieces ; the bed plate carried two uprights that supported the boring bar, which was very heavy ; this bar could be drawn out of one head to admit of the placing of the cylinder casting on the machine ; the cutter head was large and carried three cutters of steel let into slots not radial from the center of the bar, but so that the strain is thrown upon the cutter in the direction of its length. The bar is driven by a large worm meshing into a worm wheel on the bar itself.

CHUCKING LATHES

capable of swinging large pieces, but of short lengths, are not common in American shops. They have several here. They have no bed except enough of the base to support the tool carriage, which is automatically fed across the machine, but not to and from the work. These lathes are capable of doing a great deal of work that can be held in a chuck or fastened to a face plate, cylinder heads, casings, etc.

Small shapers, having a movement of but a few inches, and very small millers, are used for many purposes.

Planing and slotting machines are very heavy and massive, but all of Cravens' tools have a neat outline, though severely plain.

There are a great many multiple drills and other tools for hurrying work.

In the department of the smith shop, devoted to bolt and flue work, they use a very efficient

FORGING MACHINE.

This is a heavy frame carrying at the top a shaft on which are five eccentrics of, perhaps, an inch throw. These eccentrics move up and down plungers carrying dies, some rounded, some square at the bottom; most of the dies are double, that is, two sizes on a head; these are about an inch by two and a half inches square, of steel, and come down to anvils just like themselves; one ram carries a knife that meets its mate; at the bottom it is tapered from an inch opening at one side to nothing at the other. The smith takes an iron from the fire, and commencing at a large die can draw the piece down round, square or flat, and cut it off by simply moving it along from one die to another. The hammers or dies run very fast. While I watched this machine the smith was making heavy gate hinges, and doing it lively.

THE ENGINES

are American built, most of them, yet they build some themselves, but all bear marks of the individuality of the mechanics in charge. All the frames are solid, the lower rail being welded in.

Some of the passenger engines have steel cabs, round corners, and not a screw or bolt head in sight. They are sealed with wood inside, and are the handsomest cabs I ever saw anywhere.

FOR SAFETY,

all checks are on the boiler head, making the branch pipe very short and direct; inside the boiler an open-ended pipe carries the feed as far ahead as the side check usually puts it.

INJECTORS.

They use on some old engines a class of injectors made in England and classed here as "self-contained." They are located on the boiler head above and each side of the door, where checks are located for non-lifters. These injectors contain the steam or starting valve, the check, primer and water valve. They were efficient, but rather complicated and prone to kick about starting when hot—but most of them do that.

After this style the road adopted the non-lifter, such as used by the Grand Trunk, and made it themselves at a cost of $10—without any valves or fittings—but are now applying Gresham's re-starting non-lifter. This is located back of the rear driver, and looks much like a horizontal non-lifter with the mumps. The men say it is an excellent boiler feeder.

ENGINE TRUCKS

are made with great pains and at considerable expense to guard against their getting out of square. The top frames on both sides are made in one piece by welding in the cross-ties. The form of truck is illustrated on another page.

CROWN SHEETS

on wagon top boilers are supported under the dome by crown bars, but back of the dome radial stays are used. They report good results from this plan.

THE REVERSE LEVERS

have their fulcrum on a half-inch plate to which the quadrant is fastened, the latter going through a slot in the lever, like a Baldwin. With this plan there is no chance to bind.

CYLINDERS

and steam chests are very carefully lagged with wood to prevent radiation, as most of their engines run in a very cold country. By sawing a board of the right width full of notches to miss the studs, it is not at all hard to lag a steam chest, the cylinder lagging runs to the center casting under the saddle, and the front and back of the saddles are carefully covered; the space between the steam chest and saddle is generally filled up entirely. This costs but little and cannot help but result in a saving of heat—which means fuel.

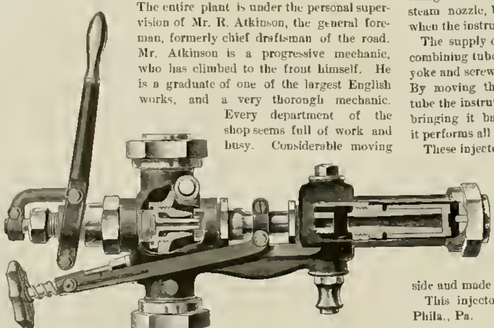
TESTING NEW CYLINDERS.

When new cylinders are built they test them up to 200 pounds before putting them on the frames. Blocking up the exhaust port by screwing down a wooden block upon it and screwing a cap on the exhaust cavity opening to the arch, the pressure tests the walls between the steam and exhaust passages. Steam passages are tested in the same way, then the cylinder heads are put on and the steam ports blocked, then pressure tests the heads, the cylinder and the walls of the steam ports both to the air and to the steam induction ports.

THE DRAWING-ROOM

is light and well arranged, and contains a full-sized valve motion model and other testing machines.

The entire plant is under the personal supervision of Mr. R. Atkinson, the general foreman, formerly chief draftsman of the road. Mr. Atkinson is a progressive mechanic, who has climbed to the front himself. He is a graduate of one of the largest English works, and a very thorough mechanic. Every department of the shop seems full of work and busy. Considerable moving of men and tools is going on in order to use the recently vacated shops of the car department.



LITTLE GIANT OF '89.

DOME COVERS AND SAND-BOXES

are made of sheet steel flanged out by hand. They are light and of neat shape, but expensive.

PIECE WORK

is done on most of the regular work; all forging is done by the pound or by the hour, most of it at one and a quarter cents per pound. Apprentices work by the hour.

A SIDE ROD KINK.

With some of their 8 wheelers having long, slab, side rods, there was trouble from broken rods, and it was decided that it was caused by the constant vibration of the rod. This was cured by clamping oak strips on the rod—top and bottom. These strips are thicker in the center than at the ends, and, being painted black, look like iron rods weighing about a ton. They are homely, but do the business.

KRUPP TIRES

and Krupp steel wheels are used under everything except freight cars. Mansel retaining rings are used.

TO HELP THE DRAUGHT

on locomotives being fired up in the roundhouse, a steam jet is used in the jack over the stack.

CHEAP ENGINES.

Labor and material are cheaper in Canada than in the States, and these shops have turned out a 17x24 engine, weighing 108,000 pounds, for $5,800.

THE CAR SHOPS

are under the charge of Mr J. Higginson, M. C. B. They build many of their own passenger cars and some freight cars. For freight service they make their own wheels in Whitney contracting chills.

FINE CARS.

This road run their own sleepers, and neater designs of finer finished cars cannot be found. Their sleepers are far above the average Pullman in convenience and beauty. Some of these cars cost $15,000.

First-class cars are not painted on the outside, but are oil finished in cherry or mahogany, and it is found that the natural cherry requires less work and looks well longer than paint.

The road has two classes of fare, even for local tickets, and emigrant sleepers of a very neat and tasty kind are run on all night trains, free of charge—there being some 250 of these cars in service.

J. A. H.

The Little Giant Injector.

The cut on this page shows the standard sized Little Giant injector pattern of '89. The cut was made to answer the many inquiries of how the new instrument differed from the old internally. There is little if any difference. As will be seen, the instrument is self-contained without other joints than the regular three connections for water, steam and delivery. The check seats on the end of the discharge tube and the starting jet is located in the steam nozzle, but is entirely withdrawn from it when the instrument is at work.

The supply of water is regulated by moving the combining tube forward and back by means of the yoke and screw shown under the operating lever. By moving the tube ahead against the discharge tube the instrument can be used as a heater, and by bringing it back toward or against the steam tube it performs all the functions of a lazy cock.

These injectors are especially good in bad water, as the combining tube can be taken out by hand, not being screwed in; once out there is ample room to clean out the instrument from four openings to the outside, and, there being no case around the combining tube, it cannot be limed up on the outside and made fast to the body.

This injector is made by the Rue Manuf'g Co., Phila., Pa.

The Railway News Reporter, under the head of "New Use for a Locomotive," tells how the manager of a shop rented a locomotive and used its boiler to run the engines of the works while new boilers were being put in, and ends up with.

"This is a novel but thoroughly practical plan. The locomotive is of 100 horse-power. Old mechanics say that this is the first time, to their knowledge, that a railroad locomotive has been thus utilized."

There is scarcely a railroad shop in the country where this is not done every year or so. We could forgive a daily newspaper reporter for a break like this, but a railroad paper (?) that dishes up such stuff, new or second-hand, must impress a railroader with the value of its information. There, now, take that.

Joseph Billingham has been traveling engineer of the Kansas City division of the C., M. & St. P. for the past three years, and has given such good satisfaction that he was offered a similar position, at much larger salary, on the G., C. & S. F. On leaving the St. Paul, the engineers gave him a handsome ring and all the good wishes he could carry away.

The Canadian Pacific furnish a pair of traversing screw jacks for every engine. These jacks can be used without the base or with it, the load can be transferred a foot or two sideways. They are very useful in case of wreck.

Every engine that comes into the Grand Trunk main shop at Montreal has stenciled in white letters over each check, "Boiler Empty." If this legend is not there, they don't come in.

The McDowell Safety Check Valve.

Our engraving shows the latest form of inside check valve, as used on the Pennsylvania road.

This check cannot be knocked off in a wreck, cannot be pounded out of shape in an attempt to make it seat, and has no pockets or obstructed passages to catch scale or other foreign matter—anything that will go through the pipe will go through the check.

The pipe connection can be at any angle to the check, as the joint next to check is made by a right and left-hand nut.

The valve can be ground in, by using the tool shown, without taking the case off the boiler.

Some years ago this check was made without a stop, to prevent the hinged valve from opening too far, and it sometimes stuck open, or the large opening caused it to hammer—this lost it friends—but it now works perfectly, some 3,000 being now in use on the P. R. R.

This device should be better known and appreciated by engineers. It is sold by the Foster Engineering Company, 81 Fulton street, New York.

New Rail Chair.

The engraving on this page shows a new pattern of rail fastening designed by Geo. W. Rittersbach, 24 North 36th street, Philadelphia. The chair is very cheaply made, the lower plate being formed at one operation, hot or cold. It prevents spreading of rails and is an insurance that the rail will not turn over. It is at once a tie plate and rail brace, such as used for curves. With this tie there is no pulling strain put upon the spikes. It can be put in without taking out rail.

The Grand Trunk Shops at Montreal.

(Editorial Correspondence.)

The Grand Trunk road of Canada was for a great many years the largest road in the British provinces of North America and still does the greatest business per mile of road. It is built, equipped and manned more on the English plan than any other American road, and is therefore interesting to Americans.

It is owned in England and most of the general offices are in London, but they seem to have had good judgment in the selection of operating officers, who have left their prejudices at home and have held fast to such English devices and systems as seemed better than those to be found here and have adopted everything American that is better suited to their needs.

A great deal of the road has a complete English block system and the yards are well protected by signals. We noticed that all main line switches and signals had lights much better than those usually seen here, larger and clearer.

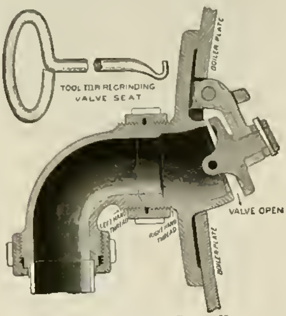
Seventy-pound rails are used on much of the road, and the track work seems to be especially well done, split switches used and modern rail splices and chairs are to be seen.

The Grand Trunk operates 3,419.5 miles of road, using over 1,000 locomotives.

I went into Canada over the world-renowned Victoria tubular bridge. This bridge is the only one of its class in America; it was built in 1859 by that eminent English engineer, Robert Stephenson, and consists of twenty-five spans of square iron tubes supported on masonry piers. These spans of iron tube are 27 feet deep and 14 wide; the bridge rises from each shore to the center; on the American side the tube is tight and as dark as a tunnel, but on the Canadian side the plates at the top have been cut out in the center, which allows the smoke to escape and gives light and air. The bridge has one span of 330 feet and 24 spans of 240 feet, and is one mile and three quarters long, including approaches. It is strong beyond all needs, but the first cost and maintenance is something enormous, as compared with modern bridges. The top and bottom plates of the bridge are double and cellular, while the sides are single plate, on each span there is a light iron framework that can be moved along over the span to accommodate the painters. Enormous quantities of rust are taken from the tube every year, and you can judge of the job of painting when I tell you that the tube has an area of over thirty acres. When Stephenson finished this bridge be went with John A. Roebling, the builder of the Niagara suspension bridge, to see that grand pioneer of great suspension bridges. Looking at its graceful lines long and silently he turned at last to Roebling, and, shaking his head, said, "If your bridge is a success mine is a magnificent blunder."

THE SHOPS

are located at Point St. Charles, close to the bridge, and are very large and well arranged for shops of their age and kind. All the buildings are of brick, well lighted both with side and sky lights. There seems to be a good-sized shop for every process of car or locomotive work; almost all the principal parts of a locomotive have a room or a building for its repair.

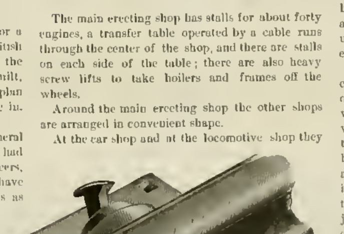


THE McDOWELL SAFETY CHECK VALVE

The main erecting shop has stalls for about forty engines, a transfer table operated by a cable runs through the center of the shop, and there are stalls on each side of the table; there are also heavy screw lifts to take boilers and frames off the wheels.

Around the main erecting shop the other shops are arranged in convenient shape.

At the car shop and at the locomotive shop they have recently built a round shop, about forty feet in diameter, especially rigged up to take off and put on tires. Each is arranged with convenient cranes, presses, gauges, etc., and Pedrick & Ayer tire heaters, the locomotive shop tire house being prepared to handle tire up to six feet in diameter, while that for car shop is fitted more for small sizes and quick work. These little shops are away from the others and in charge of men who do nothing else, and can therefore be depended upon to do their work fast and well.



NEW RAIL CHAIR.

These tire rooms seem to be a fair sample of the plan the management have in mind for the whole works, for each job is being done in a shop especially fitted for it; even the blacksmith shop is divided into departments.

SUBSTANTIAL IMPROVEMENTS.

I noted particularly the substantial work done on the plant. No expense seems to have been spared where a place has been refitted, and no make-shift or "good enough for the present" arrangement seems to have been invested in—this is not the usual plan followed on American roads. Some pretty good looking tools that were out of date were standing near the scrap heap, having been replaced by new ones.

AMERICAN TOOLS.

These shops were originally equipped with English tools, and a great many of them are still in use, and some of the new tools are of English make, especially heavy tools, such as flanging machines, etc., but most of the new machines are of American make. The managers of these works seem to have selected from the markets of the world what they considered the best for their work.

FILE CUTTERS.

In one shop they were putting up two file-cutting machines to re-cut old files and make new ones; these machines are of English make, of a new design, simple and very efficient. In this room they were also erecting two wire nail machines.

NEW ENGINES.

They were just finishing up an order of 20 heavy passenger locomotives at the time of my visit, these engines are especially heavy in the frame and in all the valve motion and running gear. Krupp tire with Mansel retaining ring are almost exclusively used both for truck and driving wheels.

THE LOCOMOTIVES

are unlike anything in America in appearance, although many of them are of American build, many of the older ones were built by Dubbs & Co., at Glasgow, Scotland, but the standard engine they build themselves. They have, as a rule, straight boilers that look small for them, the jacket is of thick iron or steel and is painted like the rest of the machine. All their new engines are painted a dark red all over—boiler and all—the jacket bands have a slight stripe of black and white along their edges and the tanks and cabs are neatly lettered, the engines look nice and are as easily kept clean as anything can be.

The boilers are strong and well made, and great care is exercised in covering them to prevent loss of heat. Angle irons are bent around the boiler, over which a stiff wire screen of ¾ mesh, 18 gauge galvanized wire is formed, leaving an air space next to the boiler; over this wire jacket they put a blanket of mineral wool, this is about an inch and a half thick, then over this a jacket of planished iron or steel is formed, and painted as they finish them in England; this makes a very substantial job. They cover the fire box as well as the barrel of the boiler, and fit pieces of lagging and jacket between the frames on each side of the box.

THE CABS

are comfortable, and arranged on the American plan, the throttle levers are fastened with a screw in the lever operated by twisting the handle; the injectors are all non-lifters, of their own make, they are placed horizontally on side of fire-box and between the drivers on 8-wheelers. These instruments are cheap and effective, easy to operate, and not liable to fill up with scale. Sight-feed lubricators are used some, but not on freight engines.

Cast-iron guides are very much used; they are very heavy, and on some suburban engines are completely covered with sheet-iron to protect them from snow and ice.

Straight stacks are the rule and extension are common.

All passenger locomotives are equipped with Westinghouse brakes.

The Scotch engines and a few of their own build have plate frames, but most of them are of the American style, but heavier. Solid-ended rods are very much used. Six-wheel connected engines are used in the heavier frieght service, but 8-wheelers are the rule.

THE GRAVEYARD.

In the yard there were some thirty locomotives of all kinds and sizes, mostly from the small roads in the West that have recently come into the hands of the G. T.

ROUNDHOUSES.

Two square stone houses with a turn table in the center of each are used for roundhouses, or, as they are called here, "running sheds"; the tracks radiating from the table turn in the direction of the length of the house and each track holds several engines.

The shops are well painted outside and white-washed inside, and the grounds are clean and orderly, and very large, the yard being very extensive.

The enginemen on the G. T., and in fact on all the Canadian roads, are as a rule progressive men, well posted and up with the times. The shop men are of many nationalities, but most of the laborers are French. Near the manager's office there is a large building containing a library, bath-rooms, a theatre, lecture-room and eating-room. The library is large, well supplied with books and periodicals, and contains many instruments and other educational apparatus. One of the largest and finest terrestrial globes I ever saw is here suspended from the ceiling by a wire rope; it was presented to the library by Sir Joseph Hickson. The eating-room is provided with seats and benches where the workmen go to eat their lunch; at 12.30 a gong sounds, after which they are allowed to smoke—looking in here at 12.45 you see a cloud of smoke, smell everything that will burn, and hear a babel of voices.

LIBRARY TELL-TALE.

In the library they have a large board in a case, some 5 by 20 feet, this board is filled with regular rows of small holes, each hole being numbered, each number represents a book, the name of which, and the number, can be found in the catalogue, when a book is out a red peg is placed in the hole representing its number. If you want to read Ben Hur and find it is numbered 1,200, and see a red peg in that numbered hole, you need not ask for it—it is out—while if the hole is clear the book is to be had for the asking. There are two opposition societies who give alternate exhibitions in the theatre every two weeks.

FIRE DEPARTMENT.

They have a fine fire engine or hose-house, in charge of a veteran, who keeps things in apple-pie order; there are several fire companies and considerable rivalry, the company grant them time at stated intervals to exercise and train for fire duty; the rooms are filled with cups and other trophies the teams have won. J. A. H.

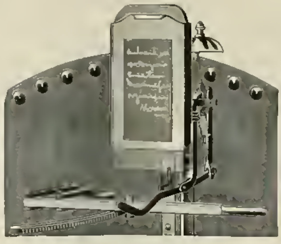
The great Scotch locomotive builders, Dubs & Co., Glasgow, have a yearly capacity of 200 engines and employ from forty to fifty draftsmen and apprentices, besides some twenty girls who make tracings for shop use. In America, with improved systems and blue prints, seven to ten draftsmen and half a dozen apprentices do the work for shops of the same capacity.

Bishop Walker's church on wheels, lately turned out by the Pullman shops, has been succeeded by a steamboat church, built in St. Louis for the Rev. M. A. Shepherd.

Kemp's Order Holder.

There seems to be quite an epidemic of order holders for locomotives, and if they show no other improvement or advantage, are worth their weight in gold to any railroad in making all orders accessible to the fireman and the head brakesman.

The holder shown herewith consists of a front glass, hinged at the bottom, a tin slide and a back piece, also an alarm bell, all set on boiler-head, as shown.



The orders are placed under the glass, the closing of the frame sets the lever of the alarm, so that, in opening or closing the throttle, attention is called to orders.

When the alarm is not wanted, the lever can be thrown up out of the way; but, if an order is put in, it will reset the lever for alarm. When an order expires, it is filed in the back of the holder for reference. A lamp, not shown in the engraving, accompanies the holder.

The inventor, C. W. Kemp, is an engineer on the Ft. S. & K. C., and his address is Charlestown, Ill.

Cy Warman's paper, the *Western Railway*, of Denver, came to hand this month with a touch of Colorado sunset on the cover and two dollars' worth of stuff inside. If Cy. would quit railroad writing and devote himself exclusively to the manufacture of poetry he would starve to death sooner, and then he might have a "statoo" in Central Park, like Burns.

The Massachusetts railroad commissioners have rendered their report in regard to the accident on the Old Colony road near Quincy, Mass., August 19 last, in which twenty-three persons lost their lives. The report lays the immediate responsibility of the accident upon Joseph F. Welch, the section master, who was in charge of the workmen who were using the track jack which caused the accident. The commissioners call for more definite and stringent regulations from railroad companies regarding the use of jacks. The report claims that the brake power on the train was not sufficient.

A Possible Chance to Keep Accurate Fuel Accounts.

The Wanamaker Car Scale Co., of Indianapolis, Ind., are introducing a device to weigh car bodies independent of the truck and no matter where the car may be located.

Their scale is located under each car, and in weighing the load the body of the car is lifted bodily from the trucks.

Our illustrations show the complete apparatus independent of the car, as well as the mode of attaching it. The four levers marked B are fulcrumed to the sills of the cars at G, and their short ends bear knife-edges on steel plates on the truck bolsters at A when car is raised to weigh. The scale beam is located in a small box under the center of the car, this box also contains a small pump.

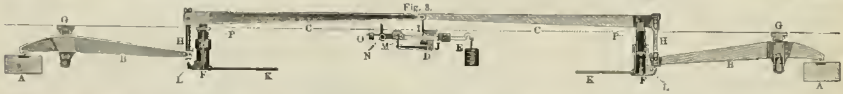
When it is desired to weigh a car, a few movements of the pump lever pumps oil into the four hydraulic jacks, marked P, that lift the body of the car up on the lever system, where it is weighed. The closing of the door of the scale box releases the oil in the pump cylinders and lifts the knife-edges from the bolsters.

Whatever advantages this scale may have for cars, there is no doubt it would furnish a splendid plan of keeping correct fuel accounts if applied to tenders. With it the tender could be weighed just before and just after loading coal, and a true record of each engine's fuel kept; it would do away with guesswork, prevent the charging of shrinkage to the motive power, and help establish some reliable facts concerning the consumption of fuel that are badly needed.

Laboratory tests of oil do not always prove what real value the oil is in actual service. The road is the best place to test oil.

Fig. 2.

Fig. 3.



Invention of the Block System.

An Englishman named Little is claiming to be the inventor of the block system of signals, dating his invention as 1865, and asking remuneration for his services from the government. Mr. Clement E. Stretton, the able counsel for the Associated Societies of Locomotive Engineers and Firemen, of Great Britain, has proven that Mr. Little has no claim to the invention whatever. He says:

* * * "As early as December, 1839, the Great Western Company telegraphed the arrival and departure of trains from station to station between Paddington, West Drayton and Hanwell, and if a second train approached any telegraph station before the previous one was telegraphed as 'arrived,' it was stopped by signals. To all intents and purposes, this was the object and spirit of what we now call the block system. In 1841 Mr. Cooke introduced separate instruments, to be used only for train signals, and in which the needle was held over to the words 'stop' or 'go on.' He also had an electric bell, to call attention. He further introduced the 'obstruction' signal, which was to ring the bell violently in the same manner as the driver

uses his whistle in case of danger. This use of the bell implied 'danger,' stop all trains in any direction."

Mr. Little says " The word block was not used in connection with railway signaling until after his publication in 1865." How any person can make such an absurd statement I am perfectly at a loss to understand.

I have now before me the instructions for block working upon the Eastern Counties Railway in 1844, they are headed: " Regulations for train signaling by block telegraph system." I can also myself well remember the block system fully thirty years ago, or five years before Mr. Little even claims to have invented the system.

The brakeman who failed to go back the required distance at Roger's Ford, on the Reading road, the night of Nov. 1, from which a fatal wreck happened, has been arrested for culpable negligence. He ought to be in jail if he did not get back far enough when he had time

The Pope Manf'g Co., of Boston, Mass., are sending out their calendar for 1891. It is in the shape of a desk pad, with pencil and pen rack, and has a place for memoranda for each day in the year. If you tell them where you saw this notice they will send you one.

In proportion to its length, the Manhattan elevated railroad is the most prosperous and the largest money-maker of any railroad system in the world. There are many roads having a mileage 100 times greater than this whose figures do not begin to compare with those contained in the annual report of the elevated system. This report has just been made public for the last year, and the figures are simply colossal. Its total receipts were nearly $10,000,000, almost every cent of which came from passenger fares. Its net earnings were nearly $5,000,000, and it was able to pay all of its enormous interest charges, a dividend of 6 per cent on its capital, and to charge a handsome amount to its surplus fund. It carried 188,000,000 passengers last year.—*Exchange.*

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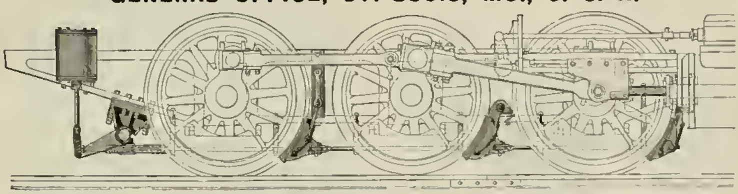

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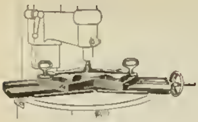

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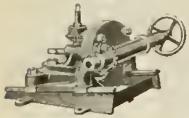

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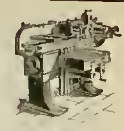
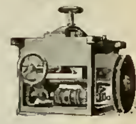
Richards' Patent Open Side Planing and Shaping Machine.



These Machines are superior in every way to the ordinary Planing and Shaping Machines. They are guaranteed as to efficiency, true working rigidity, and cutting power. Made any size required

Davis' Patent Valve Port Milling Machine.



This machine will mill out ports in valve faces of steam cylinders, duplicating work exactly and in the shortest possible time. It is operated by a rope belt similar to that used for driving drills etc. It is much lighter than the cylinder and can be readily placed in position, using the stud holes to attach to for that purpose.

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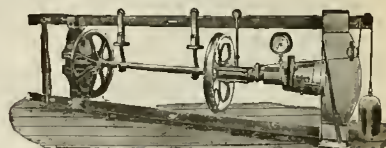

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VOL. IV, NO 2 — NEW YORK, FEBRUARY, 1891. — $1.00 per Year or 10c. a copy.

The Locomotive that Climbs Pike's Peak.

It is more than a decade of years since a western poet wrote a wild and fantastic article on how disgusted a Rocky Mountain "burro" was at finding a Rio Grande locomotive at the summit of Pike's Peak—western people would not have thought the poet more ridiculous if he had made the meeting in the moon. Yet the locomotive is there.

Five years ago the project took form enough to build a part of the grade for an adhesion road, but in 1889 the Manitou & Pike's Peak Railway feet per mile. The grades vary some, the maximum being 25 per cent. The heaviest climb is 1,320 feet to the mile. The line is crooked, having numerous curves, many of them of but 16 degrees, 39 per cent. of the whole road is on curves.

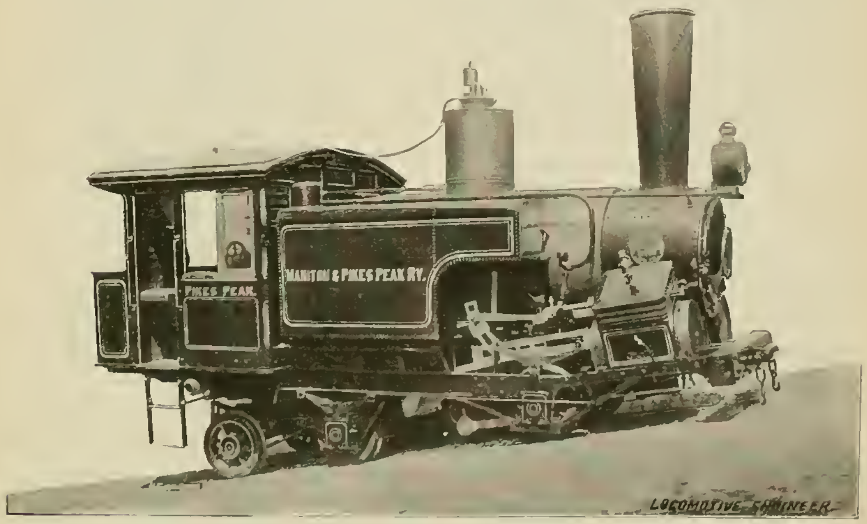
The road bed has been made wide and substantial, 15 feet on embankments, and 22 in excavations. At regular intervals the track is anchored to the rocks, to prevent its creeping down hill.

The gauge is 4' 8½", laid with 40 pound steel, these are for the carrying wheels only.

In the center of the track there is a double line of

The general dimensions of these engines are a follows.

Gauge	4' 8½"
Cylinders	17x20
Drivers	22 468
Total wheel base	11' 8½"
Driving-wheel base	4' 1½
Weight, total	53,600
Weight on drivers	50,700
Boiler, diameter	44'
Number of tubes	176
Diameter of tubes	1½'



THE PIKE'S PEAK CLIMBER.

Company was formed, with money enough to build anything, and a rack rail decided upon. The principal incorporators were the officials of the western roads most likely to be benefited by tourist travel to Manitou and Pike's Peak. Major John Hulbert of Manitou, was made president, and the engineering work placed under the charge of R E. Briggs, C E., of the D & R G Ry

Last fall the line was completed, it is just 46,158 feet long—nearly 8¾ miles. It starts from the Manitou station, at an altitude of 6 600, and ends on the pinnacle of the peak, 14,200 above the tides, the total rise being 7,600 feet, an average of 846

rack rails laid close together; these racks vary in thickness, and are in lengths 6' 8" long, having 17 teeth each; on the lighter grades, these bars of steel weigh 72 pound each, and are ⅞" thick, and on the heavier grades 104 pounds each, and are 1¼" thick, they are fast to common chairs in the center of the track, but the cogs "break joints," so that the pull of the engine is steady, and the trouble from break-downs is diminished.

Three locomotives like the one shown herewith have been built for the line by the Baldwin Locomotive Works, they are built for the Abt system, which is the double-rack rail. These engines have side tanks and a small coal bunker

Length of tubes	7' 5¼"
Fire box, length	48'
Fire-box, width	59⅝'
Fire-box, depth	F. 46¼, B 40⅝
Water space	F. 3½, S. & B. 2½"
Staying	Radial
Truck wheels, diameter	25½"
Truck journals	4x8
Driving wheel centers	15¾"
Main axle journals	6x7
Driving axle journals	7¼x4¼
Support axle journals	6x6
Carrying wheels, diameter	25½"
Carrying journals	4¼x6

They are carried on six small wheels, the two forward pair being rigid in the frame, and 80 inches apart; the back pair is a pony truck, with the radius bar pin just back of the axle of the center pair of wheels.

The outside frame is rigid with the cylinders, and extends back under the cab and fire-box on a level. The inside frame is fastened to solid boxes on the carrying axles, and has a flexible connection to the outside frame, just back of the cylinders in front.

This inside frame carries the three double, toothed drivers in the center of the frame and the engine drum and main shaft.

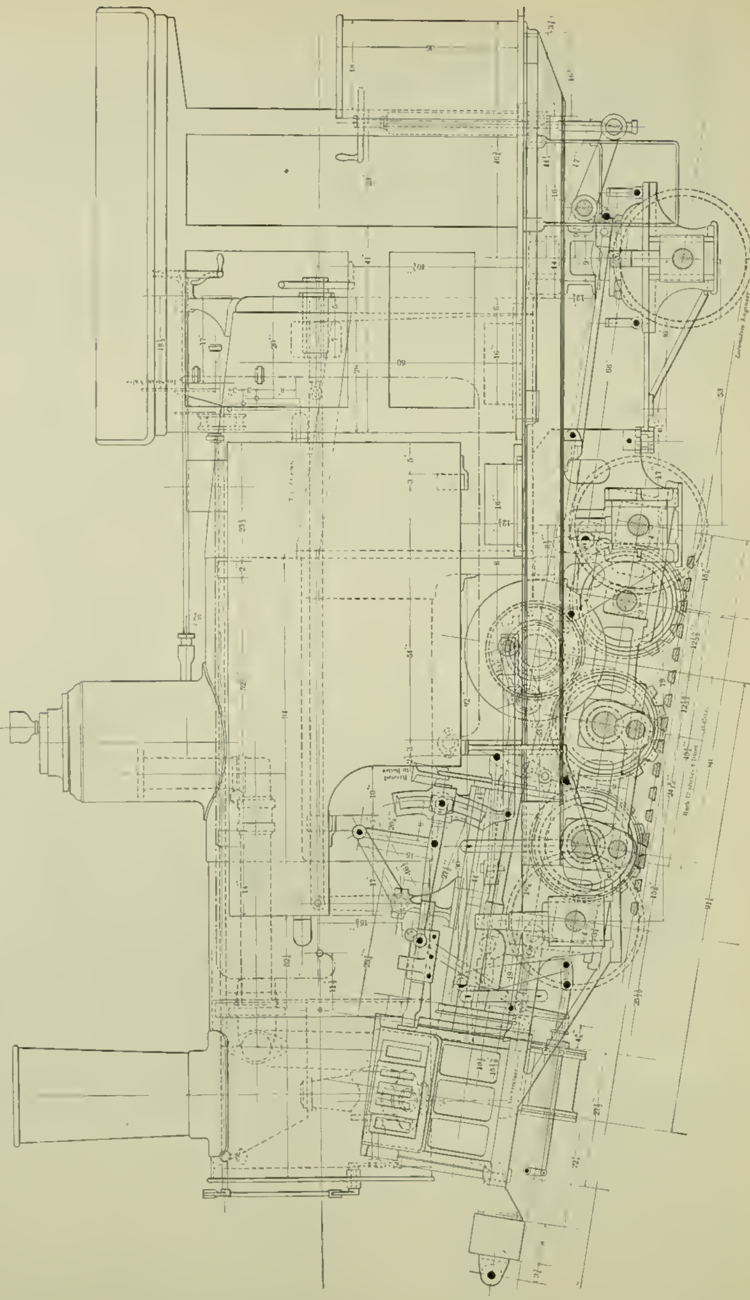
Thus the boiler and frame can move on the springs and equalizers without disturbing the mesh of the gears in the rack. This you can see in the cut on this page.

The main rods from the crossheads turn the master shaft, and gears on the shaft mesh into and drive the two back toothed drivers, the forward one being driven by side rods from the central driver.

On each main pin there is a return crank that performs the functions of an eccentric in moving the stationary link of the Walschaert valve gear, the motion being handled through the system of levers shown, and the screw reverse gear.

On each side of the geared drivers there is a heavy corrugated drum for brakes to operate on, these are of the strap pattern and heavy throughout, and operated by steam. There is also a valve arranged in the exhaust pipe in such a way that the cylinders may be used as air-pumps to operate these brakes. There is also a hand-screw brake in the cab, and the cylinders are fitted with the Le Chatelier or water-brake. The throttle is of the screw type placed on top of the boiler.

The cylinders are 17x20, and placed at an incline of one inch in six and a quarter.



THE PIKE'S PEAK CLIMBER.

The tank holds 700 gallons, and will be filled four times in a trip up.

The passenger cars have a capacity of fifty persons, and will weigh, loaded, 42,000 pounds.

The service which these locomotives were guaranteed to perform is as follows: On a road, 8¾ miles long, ascending, say 7,600 feet, and having maximum grades of 25 per cent., and maximum curves of 359 feet radius occurring in combination with a grade of 22 per cent, each locomotive shall be capable of pushing 42,000 pounds of cars and lading at a speed of five miles per hour on a grade of 16.33 per cent

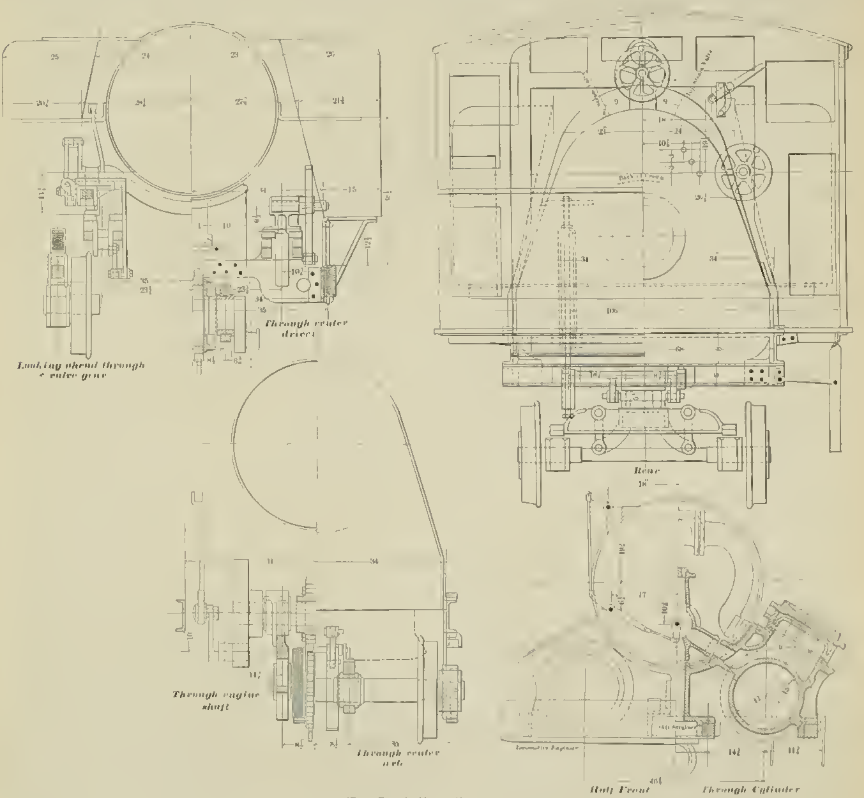
Speed of three miles per hour on a grade of 25 per cent.

Speed of eight miles per hour on a grade of 8 per cent.

In no case will speed exceed eight miles per hour.

They have from the first performed this work satisfactorily, and we are informed through reports to their builders, that, with their continued service, they are developing still better results, and using less fuel and water than was calculated upon.

This is the first publication of the details of these wonderful little engines, and their success will probably establish them as the standard rack rail engine for future mountain roads in this country, of which, no doubt, there will be not a few at no late day.



THE PIKE'S PEAK CLIMBER.

Danger of Roundhouses in Case of Fire.

In a recent article by J. Davis Barnett, superintendent of the locomotive shops of the Grand Trunk, at Stratford, Ont., reference was made, says *The Engineering News*, to the almost universal American plan of designing locomotive roundhouses so that all the tracks converge at a turntable pit outside. Mr Barnett called attention to the serious defect in this plan, in that all the locomotives must pass over the turntable, and in case of accident to this, or in case of derailment on the narrow exit tracks beyond, all egress from the roundhouse may be blocked. Instead of this American type of engine house Mr. Barnett favored the English plan of building engine sheds with longitudinal through tracks, so that in case of accident to one exit another can be used.

A recent occurrence in the yards of the Delaware, Lackawanna & Western Railroad, at Montclair, N. J., illustrates well this defect of the prevalent American system. At about 1.30 A. M., January 20th, fire was discovered in the freight house at Montclair. The local fire companies were slow to arrive, and the fire spread so rapidly as to endanger some of the cars standing on tracks near the freight house. Several engines were in the roundhouse, and one was immediately started out to move the cars to a safe position; but in the hurry and confusion it went off the track at the turntable, which, of course, blocked all the other engines from passing out. Some barrels of kerosene on the freight house platform burst, and their burning contents ran down the tracks, setting fire to six passenger coaches and six box cars, which were totally destroyed The total loss by the fire will approach $100,000.

The radial type of engine house has certainly some advantages, but if it is thought best to use it, an emergency exit should be provided in case of accident at the turntable.

Self-made Men.

Very few of us comprehend how great a part "environment," or rather all that the word implies, plays in our lives. The general idea of men who are too busy, or too careless, to bestow much thought upon the matter, is that from the time they reached man's estate they have molded their own lives; that they have adopted such or such a business, have chosen from all the world the woman who is to be their lifelong companion, have selected their special friends, and in short have ordered their whole career, and this is the reason we so often hear of "self-made men." It is rather remarkable that it is only when a man rises from obscurity to some high position, or from poverty to affluence, that he likes to employ the term, or to hear it coupled with his name. Let his course have been in the contrary direction, and he at once disclaims having had any hand in the matter, then his own will was nothing, heredity, evil influences, bad luck, everything was against him, but, even as he speaks, he is only half convinced of the truth of his excuses; his conscience—if he have one still—whispers to him that he might have done better if he would.

But while courage and energy and perseverance are undoubtedly large factors in a man's success, they do not assure it, many a man possesses all three, and yet his career proves a failure, because his environment has been such as to neutralize them and defeat all his efforts to get on in life.—*Ex.*

In a recent editorial the types made us say that the interest on $16,000,000 at five per cent was $8,000, when they should have said $800,000 When a newspaper man gets to dabbling in money matters he is just like a green farm boy in a switch-yard at night—rattled.

The Reading lost another locomotive by the explosion of the boiler on the 13th. Three men were killed. Explosions are getting too common.

Locomotive Running Repairs.

By L. C. Hitchcock.

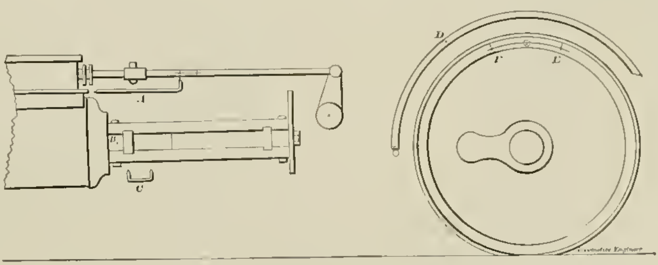
SETTING SLIDE VALVES.

Nearly every work on locomotive maintenance has a rule for setting valves, but not one mechanic in ten would follow to the letter any rule I have ever seen given while doing this work, and should a novice undertake to do this work with nothing but the rule as given to guide him I am confident that he would not meet with success

The work of Angus Sinclair is as clear as any on this subject, and, as he says, "A person can better learn this work by taking part in it." Now, in writing upon this subject I do not wish to be understood as criticising such writers as Sinclair and Forney. Nor do I intend to teach any experienced machinists in this work; but what I wish to do is to tell the younger mechanics some of my own experience in this line, and to tell them in such a manner that, by taking this paper and following the directions given, they will meet with fair success in setting locomotive valves.

We will assume that we have in the roundhouse a standard eight-wheeled engine, with cylinders 17 x24", and that the valves of this engine have been reported as being "out bad," and we are to set them. Now, if there are no rollers upon which to turn the forward drivers, and the engine has to be pinched forward and backward, you should have two helpers to do this work. The first thing to be done is to "gauge off" the engine—that is, to mark on the valve stems the points at which the valves close the steam ports. While you are taking off the nuts which hold down the steam chest covers, have the helpers disconnect the tender, and if the weather is cold they should run all the water from it into the pit, then push it outside.

It is not necessary to lift the chest covers to the floor, but just raise each and let them rest on top of the studs, then by standing on the cylinder, with the feet close to the steam chest, a man can raise the outer edge of the cover and push the inner edge under the heads of the bolts which fasten the cylinder saddle to the smoke arch, and the cover will remain in this tilted position.



Now get two pieces of thin roofing tin, about 1" wide by 10' long, rivet these together at one end, using one rivet. They can then be opened and closed similar to a pair of shears. Then go to the side of the engine where the pins are nearest on the quarter (either up or down), and have the reverse lever moved until one port is opened; then put the loose ends of your tin shears into the open port and open the tins until they will span from end to end of the port. Now have the lever moved *slowly*, and stop when the edge of the valve will have pinched the tin so it can just be moved up and down; then put a prick punch mark on that part of the cylinder upon which the steam chest rests, and with a stiff steel tram, bent as shown at *A*, and with the point on straight end in the punch mark on the cylinder, make a good deep mark on the valve stem with the point on bent end.

When the valve stems are not coupled with a "stretcher" (or right and left nut), this tram is best about 24" long. But when the stretcher is used the tram must be short enough to allow the stem to be scribed forward of the stretcher. Now remove the tin and have the lever moved until the other steam port is opened, then place the tin and repeat the operation just described.

Now have the reverse lever put in the center, or out notch in the quadrant, and disconnect the forward end of the back-motion eccentric rod on the opposite side of the engine. A helper can then take hold of the bottom of the link and move the valve stem forward and back for you while you gauge off this valve. Now see that the wedges are set up sufficiently tight to allow the driving boxes to move up and down freely. Then replace the steam chest covers, and connect the eccentric rod.

The back ends of the main rods should now be disconnected, and the crossheads be moved forward until the pistons strike the forward cylinder heads. Then mark the edge of the guides at the point where the forward ends of the crossheads rest Then move the crossheads back until the pistons strike the back cylinder heads, and mark the guides at the point where the back end of the crosshead rests. These marks are called the striking points. Now connect the main rods.

With a key seat rule now scribe a horizontal line along the valve stem, crossing the heavy lines made with the valve tram and prick punch lightly where these lines cross. Then with a small pair of sharp-pointed dividers get the exact center between these punch marks, and punch this center on the horizontal line. Now move the reverse lever until the valve tram will reach from the punch mark on the cylinder to this central punch mark, and see if the outside rocker-arm is at right angles to the guides. This can generally be done by measuring from the back of the guide yoke first to the center of the rocker-shaft, then to the center of the pin in back end of the valve stem. If these measurements are equal the stem is the proper length. If they are not, the stem must be lengthened or shortened the amount that the center of the valve stem pin is forward or back of the center of the rocker-shaft.

Look the engine over carefully now, and be sure that all bolts and nuts are securely in place, and you are then ready for action with the pinch bars.

Now, as the engine is standing under the smoke-jack, it is handier, I think, to back the engine while taking the dead centers, and, to facilitate matters, it is best to begin with the left pins on the lower forward eighth, for reasons which will be explained farther on.

Now put the reverse lever in the full back motion, and pinch the engine backward until the front end of the crosshead is flush with the back edge of the oil slot in front end of guides Then prick punch the forward guide block as at *B*, and insert one point of a small steel tram, bent as shown at *C* (the points of this tram should be about 6" apart); with the other point scribe a good plain line on the side of the crosshead. Then take a stiff steel tram, bent the same as the crosshead tram, with the points about 24' apart, and hold it in as near a level position as possible against the driver and wheel cover, prick punch the cover at *D*, insert one point, and with the other scribe a line across the tire as at *E*.

Now hold one point of the crosshead tram in punch mark on guide block and pinch the engine back carefully. The mark scribed on the crosshead will then move forward of the other tram point, and for a moment stand stationary at the dead center. It will then start backward. Stop pinching the engine when this line on its backward journey exactly reaches the tram point. Then take your wheel tram and scribe the second line on the driving tire shown at *F*. Now with a pair of maphrodite calipers scribe a line intersecting those made with the wheel tram, about half an inch above the lower edge of the tire, and carefully prick punch the exact point where the lines cross, on the line which you last made get the exact center between the two punch marks, and with a piece of chalk draw a small circle around it. This is called the dead center mark, for when the engine is moved either backward or forward until the wheel tram will reach from the punch mark on the wheel cover to one of the marks obtained in the manner described the engine will be on the dead center. This operation must be performed four times to get the forward and back centers on each side of the engine We now have the left forward center mark, the next one to get is the right forward. This is done by working exactly as you just did to obtain the left forward one. Next comes the left back center; you get this in the same manner as you did the forward ones, except that you must prick punch the guide block in the back ends of the guides, and work with the crosshead at that point instead of at the forward ends. Now for the last center, which is the right back one. After having obtained this in like manner the engine will stand with the pins on the right side, a little below the back center. Now pinch the engine back until these pins are nearly on the lower quarter, then put the reverse lever in full forward gear and pinch the engine forward, holding one point of your wheel tram in the punch mark on the wheel cover. Stop pinching, and remove the pinch bars, when the other point will go *fairly* into the center mark on the tire which has the circle around it.

Now take the tram with the straight end with which you marked the valve stem, and with the point on the straight end in the punch mark on the cylinder, scribe a light line on the valve stem. Now pinch the engine forward again and go to the left side, catch the back center and mark the stem; then go to the right side again and get the forward center, and with the valve tram make the second light mark on the valve stem. Now with the small dividers see if the two last lines scribed on the stem are an equal distance from the center point, between the two punch marks; if they are, the eccentric rod is the proper length. If they are not equally distant from the center mark, put one point of the dividers on the center mark and bring the other divider point to the light line, which is the *nearer* to the center point, then turn the divider point toward the light line, which is the farther from the center point, and note the difference. *One-half* of this difference is what the length of the eccentric rod must be changed, if the line nearest the center point is *forward* of it the rod must be *lengthened* one half of the difference shown; if it is *back* of it the rod must be *shortened* one-half of the difference. Now I consider it good policy to adjust each eccentric rod to the proper length as you go along, for this reason: We are now working on the right side of the engine, and the pins are on the forward dead center; in this position the eccentric rods are not crossed, as they would be if the engine was on the back center, and we can easily get the bolts out of the back ends of the rods and slot the holes in the straps if they require it, this we could not do if the engine was on the back center, for the rods would then be crossed, and if you wait before making the changes until you find what each rod requires, you will have to do much more pinching to get the engine into the proper positions to allow the bolts to be removed should the holes require slotting, and this is the reason why it is best, when you start to take the dead center points, to begin with the left pins on the forward center and pinch the engine backward and get the left forward center first; for then when you are ready to change the forward rods the pins will always be on the forward centers, and if you find that the holes in the straps require slotting you can remove the bolts and slot the holes, and then you can also remove the bolts from the back rods and slot the holes in the straps. After you have adjusted a rod, always pinch the engine nearly a quarter of a turn in the opposite direction from which you caught the dead center point, for by so doing all lost motion in the working parts of the engine will be taken up when you pinch the engine to its original position again; catch the center and see if the adjustment is correct. When the adjustment is correct note the lead shown. The lead is the distance that each light tram mark on the stem is outside of the port closing lines when the eccentric rod is the proper length. Should the light tram marks come inside of the port closing lines after the rod had been adjusted to the proper length, it is called blind, the distance from tram mark to port closing line.

Now to return to our work. When we have the right forward rod properly adjusted, we pinch the engine forward again and go to the left side. Catch the forward center and scribe the second light line on this valve stem. Adjust this forward rod as just described, and note the lead.

Now pinch the engine forward nearly a quarter of a revolution, put the reverse lever in full back motion, and, pinching the engine *backward*, find the proper length of each back rod, and note the lead on each side as soon as each rod has been properly adjusted. The requisite amount of lead can now be given the engine by moving the eccentrics on the shaft. Never move an eccentric on the shaft until the rod is the proper length. If the work has been carefully performed as described, the engine will be square in full forward and back motion. The engine now stands with the right pins on the back center. Put the reverse lever in the second notch in the quadrant forward of the center, or "out" notch, and pinch the engine forward, holding the valve tram in the punch mark on the right cylinder. Stop pinching when the point on bent end of tram will go fairly into the port closing line on the valve stem, and with a pair of dividers measure the distance from the striking point on back end of guides to the back end of crosshead, and write this measurement down. Then go to the left side, pinch engine forward until tram point will go fairly into the back port closing line on stem, and measure the distance from the back striking point on guides to the back end of crosshead.

Care must be taken to mark down each measurement. Now go to the right side again and pinch the engine forward until tram point will go into the forward port closing line, and measure the distance the crosshead will have traveled backward from the forward striking point. Now if this distance is not exactly equal to the distance the crosshead traveled from the back striking point when steam was cut off, then the cylinder is receiving more steam in one end than the other. For instance, if from back point be 6", and from the forward point be 8", the cylinder is receiving 2" more steam in the front end than in the back end, to make it work evenly the distance must be 7" from each point. To do this, pinch the engine backward until the crosshead is near the forward end of stroke. Set your dividers to 7", and with one point in punch mark on forward end of guide, pinch the engine forward until the forward end of crosshead has traveled backward the distance your dividers will span. Now with the valve tram make a light mark on the valve stem. The line in the present instance will come just forward of the front port closing line, and the distance between the two lines will be what the forward eccentric rod needs shortening to make the steam cut off from each end of the cylinder at 7" travel of crosshead, provided the rocker-arms are of equal length. Should the upper arm be longer than the lower arm, as is often the case, the amount to change the rod will be a little less than the distance between the two lines on the valve stem. When the *forward* end of the cylinder receives the greater amount of steam the eccentric rod must be *shortened*. When more steam is admitted to the *back* end of cylinder the rod must be *lengthened*. And when the difference is not too great the rods can thus be changed to bring the engine square, when "hooked up," without materially affecting it while working full stroke. Assuming that we have adjusted the right forward rod to make the crosshead travel equal, we will now go to the left side of the engine, and, pinching the engine forward, ascertain the distance this crosshead will travel from the forward striking point when steam is cut off. If the distances from front and back points are unequal, adjust the rod as just described. Having done this, see if the distances the crosshead travels from the left striking points are equal to those on the right side of the engine. If they are not, one side of the engine is working more steam than the other. This may be remedied by raising the tumbling shaft arm, or shortening the link hanger on the side working the greater amount of steam. Or, what is easier, and most frequently done, is to put shims between the tumbling shaft box and frame on the side using the most steam.

The amount of shim to be used can only be determined on trial, though usually every $\frac{1}{16}$" of shim will reduce the crosshead travel about $\frac{1}{2}$". It is seldom necessary to run an engine over "hooked up" in the back motion. Be sure that the back eccentric rods are the proper length when the engine is working full stroke, and also that the eccentrics are so placed on the shaft that the valves have an equal amount of lead. Then follow closely the directions just given for running the engine over with the reverse lever in the second notch forward of out notch, and I think that you will not be troubled with the engine not sounding square.

Canadian Pacific Fire Door.

Both the C. P. and the Grand Trunk roads use a form of fire door like our engraving.

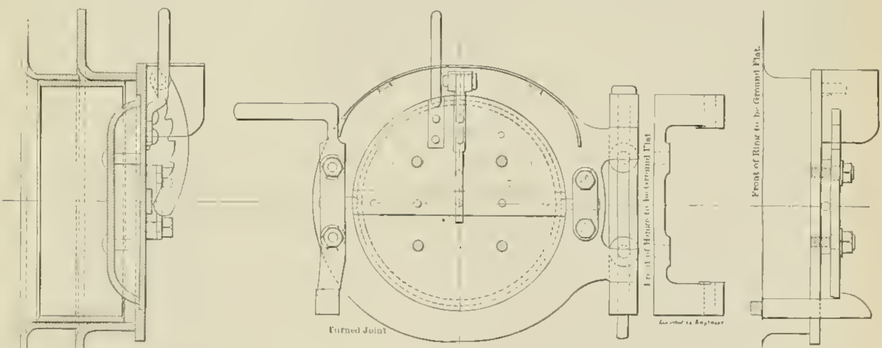
Like the general English practice, the door has a large deflector, but, like general American practice, the door swings on hinges.

The door proper is simply a ring with hinges and a latch on it. In the large opening in the center a damper swings on pivots, as shown in the center cut. This large damper is almost as large as the fire door opening in boiler, and carries on the inside the perforated liner or shield. The damper can be swung on its pivots to almost any degree by means of the upright handle shown at the top of the sectional view at the left, and the damper can be held at any point by the notched sector that drops down and engages the top of the damper casting.

Thus the damper can be set and left indefinitely, and by lifting the catch it will return by gravity to the closed position.

To get the latch out of the way of the pivoted bar carrying the damper, it is arranged as shown, with the catch directly under it.

There is no way to leave this door "on the latch"; it must be closed or open. If the engineman wishes to "cool her off" by means of the door, he opens the large damper, and by its inclination it deflects the cold air down upon the fire, under the arch, and materially assists in preventing black smoke, and the tendency of flues to weep.



John Reed, of Troy, N. Y., was convicted, on Dec. 29th, of *attempted* train wrecking at Greenbush, N. Y., on September 4, was brought into court the next morning and sentenced to Dannemora prison for seven years. His accomplices, Arthur Buett and Thomas L. Cain, entered pleas of guilty to the indictment half an hour later. Buett was given two years in Clinton prison and Cain three years and eight months. The three men broke down and sobbed aloud when sentence was pronounced.

The operators and train dispatchers of the Chicago & Erie road struck on the 20th, and the engineers, fearing to run without proper orders, stopped their trains. The management are trying new tactics, and with evidence of making it hard for the men. They have shut down everything, stopped all trains, shops, etc., suspended the pay roll entirely, and announce that they will not attempt to run trains until the strikers announce that they may. This is cheaper than fighting.

The Chicago & Alton road has notified its passenger conductors that a cash prize will be given to the one who takes up and turns in the largest number of annual passes found in the possession of those to whom they do not belong during the year.

The Consolidated Car Heating Co., of Albany, have issued their first complete catalogue, a very neat and fully illustrated 118 page book. This company control the business of five of the old companies, the most important being the Sewall and the McElroy.

James K. Verner, secretary of the Pittsburgh forge and iron works, and one of the best known iron manufacturers in the country, died in Pittsburgh on the 12th of January.

The engine mileage on the Southern Pacific for the month of November was 703,000 miles. The car mileage, 10,427,273.—*Ex.*

Combination Stand for Cab Fittings.

The accompanying engravings show a very handy form of stand for cab fittings that is cheap and easily made, does away with the necessity of drilling the boiler full of holes, and provides means for grinding in, removing, or renewing any cock in the cab while boiler is under steam.

The body is made very heavy, and of brass, flange jointed to the boiler head as shown. On this road—the Boston & Albany—the injectors are located ahead of the cab, operating rods reaching through to the engineer, and the throttles for both injectors are in the back pipe of the stand as shown. This makes the cabs more comfortable, and gives room, and there is less danger from scalding in case of accident. In this stand both injector throttles, the blower, steam heater cock, steam brake, lubricators (both hand and automatic), and the steam gauge cock are accommodated, and still there are two plugs for possible extra appliances. The stand also supports both gauges and the gauge lamp.

The Chicago Belt

The Belt Railroad of Chicago has about 22 miles of main and 20 miles of side tracks. They control the track of the old Chicago & Western Indiana into the city, and have a belt around the city connecting all the roads. They operate 33 locomotives, enough of them being double-crewed to bring the number of crews up to fifty.

The business of the road is to transfer cars from one line to another, getting them to destination without delay, and delivering loads from any part of the city to any road, whether that company has tracks to where car was loaded or not.

The road has only 125 cars of its own, of all kinds, none of which are passenger cars. The road runs no regular trains, but all hands switch, from Genesis to Revelations, though there are many long transfer runs.

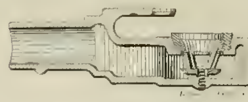
There are quite extensive shops at Auburn, but most of the machinery and tools are not as good as they could be.

The amount of car repairs must be something enormous. Peter H. Peck is M. M. of the road, and he has his hands full in looking after his own engines and everybody's cars.

Westinghouse's New Hose Coupling.

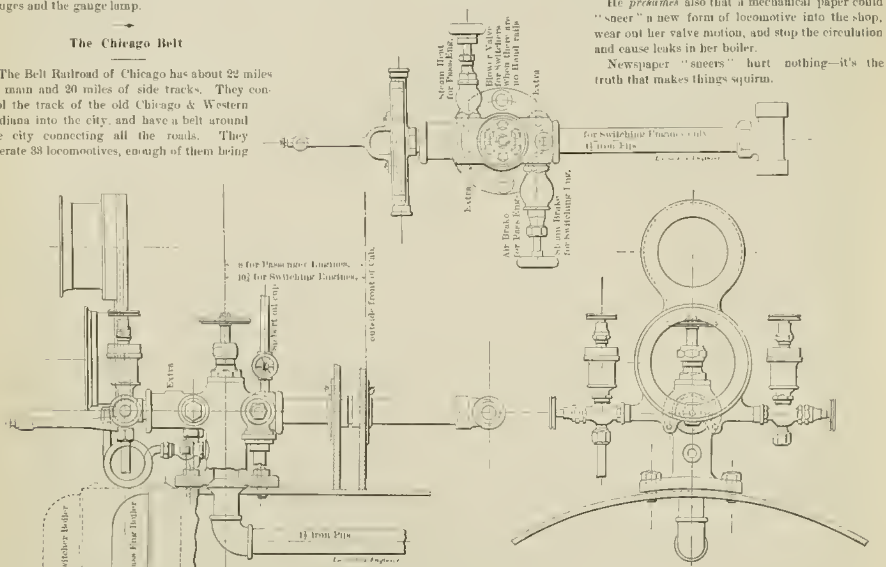
The little engraving accompanying this article shows a new method of holding the rubber gasket in a hose head. The retaining thimble is held down by a small machine screw, and is put in from the face of the coupling instead of requiring a large, air-tight joint on the back of each coupling head, and the expense of threading the hole and the cap for it. The head is just the same shape as the old one, and will, of course, couple with it, but it is lighter, has less joints, and costs far less.

This is one of the kind of inventions that pay—making some good thing better and cheaper. The old patents on the Westinghouse coupler have run



out, and they can be used or made by any one; but no mechanical officer of a road will want the old one, even at the same price as the new, because the new is simpler and lighter, easier to repair, and has less joints.

Thos. J. Hogan, of Pittsburgh, Pa., is the inventor. He has, however, sold his invention to the Westinghouse Air-brake Co.



B. & A. COMBINATION STAND.

Sad, but True.

A contemporary has said that the Boston & Albany has ordered the pilots taken off all its freight engines, and makes the statement a text of a more or less sagacious little editorial. We are informed that the statement "is not true. The company has not changed the policy which has obtained for more than 20 years." Pilots are not used on its switching engines, local freights, and gravel trains.—*Railroad Gazette.*

We are sorry that the *Gazette* man did not ask some one who knew what they were doing on the B. & A. Water boys or car cleaners can't keep posted on the going-ons in the motive power department. We will have to repeat, for the sole benefit of our contemporary, that the B. & A. are actually and honestly taking the pilots off all the freight engines.

The Sharpneck roller bearing is in use on many coaches on the Rock Island road. No lubricant is used and no attention given to it, yet it seems to do well. The cars are reported to pull much easier and require less attention than the old style.

We are in receipt of the Eighteenth Annual Report of the Commissioner of Railroads of the State of Michigan. The report is a large book of over 700 pages, replete with the usual statistics to be found in works of this class.

A Strong Man Who Knows (?)

THE LOCOMOTIVE ENGINEER says the Strong locomotive on the Santa Fe road, by which it is presumed is meant the A. G. Darwin, which was run about this city for a while, is laid up, and will be rebuilt into a compound, with a plain fire box and valve gear. THE LOCOMOTIVE ENGINEER'S opposition to the Strong engine, which has been expressed upon every opportunity, has taken the form of sneers rather than argument, and it is not, therefore, surprising to find it stated in that publication that leaks in the fire-box, caused by poor circulation, was her worst affliction, and that her valve motion developed considerable lost motion. The valve motion has been considered the best part of the engine by competent judges in this part of the country, and if plain valve gear is to be substituted, it means that the present owners of the engine are through with experiments with the Strong devices.—*Providence Journal.*

The above is a fair sample of the verdicts of some self-appointed mechanical judges.

He *presumes* the A. G. Darwin is on the Santa Fe, instead of knowing that that road bought a brand new Strong, the last one built.

He *presumes* also that a mechanical paper could "sneer" a new form of locomotive into the shop, wear out her valve motion, and stop the circulation and cause leaks in her boiler.

Newspaper "sneers" hurt nothing—it's the truth that makes things squirm.

We have never "sneered" at the Strong locomotive; as a mechanic, our editor said at the start that it would not be a practical success on the road, and told why. Since then we have simply and briefly recorded the progress of the device toward the scrap heap—where it must end.

We refer our judge to the motive power department of the Santa Fe road; the officers there may offer no opinions, but they will no doubt state the truth, viz., that there was poor circulation and constant leaks about the fire-boxes; that, to remedy it, circulating pipes were put on; that the valve gear wore badly in a very brief service, and that the engine will be rebuilt into a plain fire-box, link motion machine. These are not sneers, but simple facts. People with stock in the concern will probably still call any adverse criticism "sneers." "Competent judges in this part of the country" may not know what the requirements of a locomotive valve motion (for hauling cars) are.

If the judge is right, and the present owners are through with experiments with the Strong devices, there is hope for the engine—with a common fire-box and link motion the engine will be a very good one.

F. A. Stinard, recently with the Boyden Air-brake Company, is now in charge of the Chicago office of the U. S. Metallic Packing Co. Mr. Stinard is a graduate of the Erie.

New Form of Tire-cutting Brake Shoe.

The ordinary tire dressing shoe has steel pieces cast in it. These pieces are made as hard as possible, but the melted cast-iron when poured on and around them anneals them. This gives but one cutting power, which cannot be made more or less effective. On hilly and crooked roads the tire is not reduced on those portions not bearing on the rail and the flange, as fast as it wears on the rail under heavy engines with small wheels, while on passenger cars the tire is cut too fast. To remedy this defect, the shoe shown in the engraving was put into use. The depressions *E E* and *b* are cast on a chill, leaving chilled cutting edges, *A A*. The hardness of these edges may be varied by different mixtures of iron. On the Santa Fe, where this shoe was designed, three grades of cutting edges are made to cover all the conditions found in passenger car wheels, heavy and light engines on level or hilly divisions, so that the wheels are kept in perfect section, which was not possible before their use.

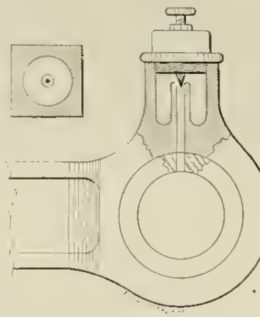
Locomotive Fuel Tests on the Southern Pacific.

A test is now being made of the relative cheapness of wood and coal for use of locomotives on "the hill," in the jurisdiction of Superintendent Wright, between Sacramento and Truckee on the Central Pacific. Fuel is one of the most important items of expense of railroading in California, and the result of the proposed test will be watched with the greatest interest in railway circles. Every factor that can enter into the relative cost of wood and coal as fuel for locomotives will be calculated with the utmost precision. The number of cars, with the exact weight of each, the weight of the locomotive, and of the water in the tanks, and of the wood in the timber will be taken. Few people realize the amount of fuel it requires to operate the section between Sacramento and Truckee. An ordinary light eight-wheeler will use up about twelve cords of wood to Summit from Sacramento—the amount of course varying with the size of the train—while one of the heavy "hog" engines will chew up as much as eighteen cords in the same distance. The quantity of wood annually used on the division is enormous. If it were piled eight feet high by two feet in width, the ordinary length of locomotive wood, it would make a pile fifty miles long. This is only a reasonable calculation of the amount of wood that is used annually on "the hill." Last year the quantity was much greater, and this calculation only applies to years when the winter ranks about average, and when the business is fair.—*Alta California*.

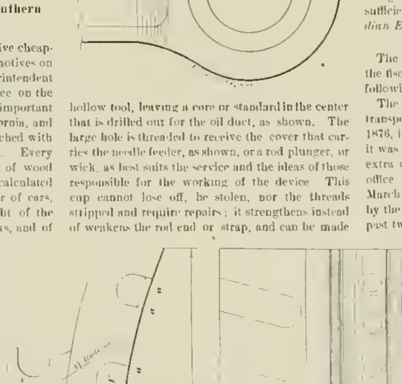
The so-called strike of the agents and operators on the line of the Chicago, Milwaukee & St. Paul Railroad has developed a new feature in railroad operation, which presents an interesting question. It seems that at a small station in Iowa, containing about 500 inhabitants, where the operator resigned, the people refused to have anything to do with the new representative of the railroad sent to that point, even to the extent of refusing him living accommodations. Under these circumstances but one recourse appeared to be open to the company, and they consequently withdrew their agent and closed the station. This move not being appreciated by the residents of the town, they at once made application to the Iowa railroad commission to have the station reopened, and it is stated that an order to that effect will be issued. Just how the controversy will be settled does not yet appear. Perhaps the commission in their order for reopening the station will be kind enough to designate to the railroad company some method by which its agent can be fed and lodged at that point, and also give some reason for ordering station service at a point where the inhabitants refuse to have anything to do with the duly authorized representative of the company.—*Ry Review*.

A Solid Oil Cup.

The accompanying illustration, which was made from a sketch from memory, and not to scale, shows the plan of a cheap and substantial oil cup, formed on a solid rod. The place usually left for the oil cup hole is simply extended up a little, perhaps less than shown, and the cup bored out with a



hollow tool, leaving a core or standard in the center that is drilled out for the oil duct, as shown. The large hole is threaded to receive the cover that carries the needle feeder, as shown, or a rod plunger, or wick, as best suits the service and the ideas of those responsible for the working of the device. This cup cannot lose off, be stolen, nor the threads stripped and require repairs; it strengthens instead of weakens the rod end or strap, and can be made at small expense on any form of rod, but seems peculiarly adapted to the solid-ended rod. Once made it is a fixture. They are in extended use on the Grand Trunk and the Canadian Pacific.



Section A. B.

TIRE-CUTTING SHOE

We have an inquiry for a description of the Hassen air-brake, a California invention. Who knows what it is like?

Improved Boilers.

Three locomotives have just been turned out of the Grand Trunk shops at Point St. Charles, and are intended to run between Niagara Falls and Point Edward. They are built for speed and durability, as well as being of finished design. The driving wheels are 6 feet 6 inches diameter. The cylinders are 18x24 inches in dimensions, with a 24-inch stroke. They have mansells capable of retaining the tires on the boilers, and, in fact, every appliance known to the modern locomotive.—*Port Huron Times*.

Leather Brake Shoes.

Experiments in New South Wales with brake shoes made of compressed leather show that the coefficient of friction is so much greater that 40 pounds of air pressure are as effective as 70 pounds with iron shoes. The leather shoes weigh 4½ pounds, as against 21½ pounds for the iron shoes. The shoes are made of waste leather scraps steeped in a softening solution and subjected to hydraulic pressure sufficient to mold them in the shape desired.—*Indian Engineer*.

The annual report of the Postmaster-General for the fiscal year ending June 30, 1890, contains the following:

The rate of compensation to railroads for mail transportation was established in 1873. In July, 1876, it was reduced 10 per cent., and in June, 1878, it was further reduced 5 per cent. In the matter of extra compensation for the use of railroad post-office cars, no reduction has taken place since March, 1873, though concessions have been made by the companies in the matter of space. In the past twelve years no reduction of rates has taken place, though the freight rates upon all railroads have been steadily lowered. During this period the weight of the mails has largely increased. It is quite reasonable to say that the reduction in freight rates generally between 1878 and 1890 is not less than 20 per cent., and in many instances it is much more. The largest expenditure of the department is for transportation. The estimates just sent to the Treasurer for the next fiscal year cover $22,610,128.31 for railroad transportation alone.

We recently saw three switchers standing in a yard, close together, but not all belonging to one company. All had driver brakes, one the old-style, American, double-piston, spread, steam brake, the second had a vacuum brake, and the third had an American brake operated by air. The first device leaked so you could scarcely see the engine, the second had two shoes out of the six off and braking against the beam-heads, and each arm to the diaphragms was loaded down with broken drawheads, links and short pieces of rail. The air-pump of the third was dancing along about eighty miles an hour, trying to supply air for a half-inch split in a pipe, the wounded pipe having been poulticed with a piece of old overall, and some wire, but the bandage had slipped.

Mr Angus Sinclair, secretary of the American Railway Master Mechanics' Association, has issued the following circular: A general index of the annual reports of this association, from the first to the 23d, inclusive, has been prepared and is ready for sending out. Members desiring to obtain the index will receive it free of charge, on applying to the secretary. The index is of service only to those who have the back reports and use them for reference.

The Jull snow excavator recently purchased by the P. R. R. has done some good work on the road. The company have two new ones nearly complete at the Rogers Locomotive Works.

Who was the first to use a cast-iron brake shoe?

The South Carolina Cup.

On the South Carolina Railway, where J. H. Agnew is master of machinery, they use a novel oil cup that is possessed of numerous advantages, and gives splendid results; they cannot be broken off by rough usage and are cheap.

As will be seen by our engraving, which is full size, they are totally unlike other brass cups.

The stem that screws into the rod strap extends into the cup to carry the feeding device; this stem is made of machinery steel, and is not fast to the cup proper in any way; it simply extends through a plain hole in the bottom of the cup, and holds it in place by the pressure of its flange against the bottom.

The cup is put on and taken off by a socket wrench, also shown in the engraving.

The feeder is a common wood screw acting as a plunger, its throw being regulated by a set screw. With 1-32 of an inch of lift to the plunger this cup has run 10,0 miles, and fed out but ¼ of an inch of oil. The steel shank is a big improvement over its weak sister made of brass.

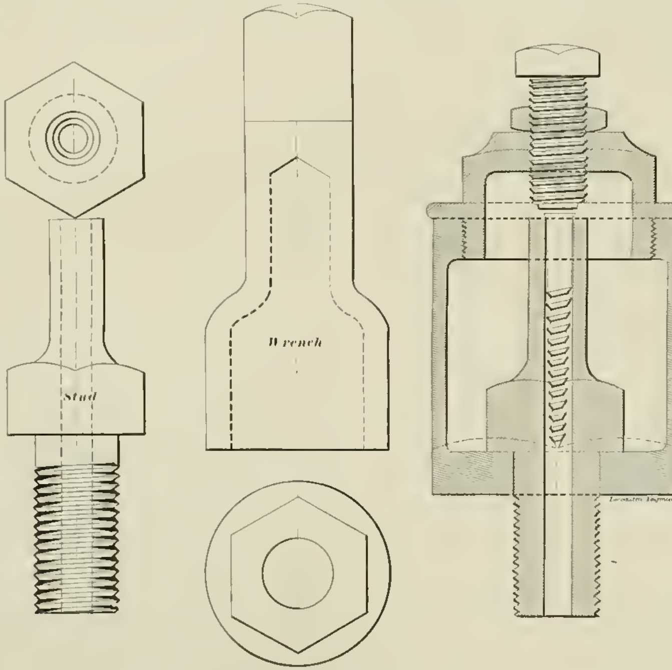
The P. R. R new P's have a weak dome cap; the second one blew off in Pittsburgh recently. They have reduced the pressure on these boilers to 140 until the domes can be repaired.

Soldering.

Under date of Jan. 14th, the associated press dispatches say:

The State Board of Arbitration, in a special report to the legislature on the late Central Hudson Railroad strike, makes several suggestions for legislation. The board urges that entrance into railway service should be by enlistment for a definite period upon satisfactory examination as to mental and physical qualifications, with oath of fidelity to the people and to the corporation. Resignation or dismissal from such service to be permitted for cause, to be stated in writing and filed with some designated authority, and to take effect after the lapse of a reasonable and fixed period, and any combination of two or more persons to embarrass or prevent the operation of a railroad in the service of the people to be regarded as a misdemeanor.

Great changes have taken place this month on the U. P. Harvey Middleton, superintendent of M. P., and John Wilson, assistant, have resigned, and Joseph H. McConnell, for many years in charge of the North Platte shops, has been made superintendent of M. P. Fred. Metzheimer, assistant superintendent, in charge of the new shops at Cheyenne. James H. Manning will be master mechanic of the Eastern Division; John O'Hearne, general foreman of the Omaha shops, and Thomas H. Dailey, chief clerk of the motive power department. All are old U. P. men.



The South Carolina Cup.

Correspondence

Air-pump Valve Stops.

Editor The Locomotive Engineer:

I would like to ask W. F Relyea or some of the other air pump doctors how they get the lengths of valve stops without taking off steam cylinder, as they run in lengths from ⅝ to 1¼ inches, owing to the difference in thickness of center casting. Will he please inform A Reader.

Wilmington, Del.

Why Does a Steam Whistle Extinguish Lamps?

Editor The Locomotive Engineer.

In your reply to Question No. 4, January issue, as to the reason why a lantern in the cab goes out when the whistle is blown, I do not think your explanat on accounts for it in all cases.

In 1866 I sold tickets at Pittsfield, Mass., on the Housatonic Railroad. It being the end of the road, the train after being made up stood for some time at the station, and the locomotive was directly opposite my outside window at a distance across the platform of at least six feet. On the window frame of my office was an ordinary bracket kerosene lamp. One of the rules introduced at that time by Superintendent Hunt was that the engineman should sound a blast of the whistle five minutes before starting. There was one engine (the Litchfield, I believe,) whose whistle was pitched at a lower key than the others, and when blown it always put out my lamp. The distance from the whistle, and the fact that the locomotive stood out-of-doors, seems to prove that there must have been some other reason than the partial exhaustion of the air. I attributed it to the vibration due to that particular whistle, no others having the same effect. Why the vibration should have extinguished the lamp I am not so sure. R. W. Pope.

12 *West 31st Street, New York.*

Forewarned is Forearmed.

Editor The Locomotive Engineer:

Bein' troubled in mind regardin' the futur' (this world, I mean,) and knowin' you was in with some of the men what has shops and stores I tho't you might be able to help me, fur my job ain't goin' ter last long, ef what I heard t'other nite is tru'. I've bin leanin' out the cab winder watchin' signals and keepin' my hand on the throttle, knowin' that any mistake meant axident, and maybe death, to the mothers and babies and little girls and boys what ride on the owl train; but all my leanin' won't be no use now. It's kinder nice to feel that you are responsible for sumthin', even if it's only the old scrap heap that runs extra or owl sometimes, but I must soon bid farewell ter even this pleasur', as the locomotives must go ter scrap; at least that was what I heard at the Franklin Institute (which was called fur that chap that used ter coax lightnin' on a kite string) not long ago, for he said (Prof. Marks, but he ain't no relation) that in a few years the locomotives would be in ther scrap heap, so I want ter get you to look after a job for me—sumthin' easy and kinder decent like. He and another electrical chap named Bell (Dr. of lightnin' or sumthin' of ther kind) went on ter tell us how the moter could just hum and hum and git there, and not have ter lug coal or water, only just scrape up what lightnin' they wanted from a rail or rod and just *fly*.

Wal, I ain't no flyer, and so would be kinder skeery to run one of them things, even if they would let an old plug-puller run one. But sum of the things they told us seemed a leetle queer to us railroaders, for they told about askin' an engineer of some fast train how many j'ints he had ter oil, and after stoppin' fer a s cond or so he told 'em just 64 And they said that if he failed ter oil any one of them 64 holes it meant accident to ther train. Guess they never seed a man makin' up time on a fast run, and not stopping ter oil or anything else for a 60-mile run. But I want ter see ther chap that can count up ther j'ints in ther motion and all ther fixin's under ther machine in a minute, or even two; some can't in a month, and as fur axident or death in case a man forgot to oil, wal, I guess all ther railroading he ever did was on paper in sum office where ther wind all came from ther register Of course, if I am ter git thrown out of my job I s'pose I must hustle 'round and git sum stationary engin' ter play with, as I b'lieve they haven't said we can't do that yet; but it seems kinder queer to me to hear them say it is cheaper ter make ther power at one place and then send it scootin' through a leetle wire way along fer miles, and scrapin' it off as they want. Maybe it's all right, but it seems kinder hard on ther old loco ter send her inter the scrap heap just as they have begun ter git her whare she is doin' sumthin' in the coal-savin' line, and is gittin' so she can hustle trains in purty good shape.

Then, again, it seems as tho' ther' was a big chance fer ther fluid, or whatever it is, ter get loose on ther line, ter kinder radiate, ef ther stuff is built anything on ther steam line, but of course we don't know, fer they tell us about their volts and such like things that we ain't got no time ter read about (and maybe wouldn't if we had), but what I want ter find out is how ther j'urnals can be kept decently cool if they add any heat ter the axles. For I've felt of several armatures (kinder careful like, fer I'm a little skeery,) and they always seem kinder warm, without takin' their runnin' heat inter account (felt of them after they had just stopped), and it seems ter me that addin' heat ter the axles ain't ther way ter keep journals cool. But then it's queer stuff anyhow, and we ain't posted.

Camden, N. J. R. E. MARKS.

P. S. No relation ter the Prof.

In a Criminal Condition.

Editor The Locomotive Engineer:

I see a great deal in your paper about pooling engines. I would like to tell a little about those that I handle. I have been running pooled engines about two years, and it is the meanest kind of work. The other day I broke down and had to take my engine down on one side with a monkey-wrench and a coupling pin for a hammer. As a general thing there are no other tools on an engine that runs in the pool, and the glass broke out of half the windows in the cab; headlights never get cleaned, and don't throw as much light as a common lantern. When you want green or red signals, you must steal them from another engine, and leave that fellow do the same. Oil cans all leak, and have no tops or lids on them. What windows that are not broken are that dirty you cannot see through them. One scraper for the fireman, and no tank boards to hold coal, and if you ask the boss for anything he will tell you that so-and-so got along yesterday without it, and so must you. So much for running pooled engines.

Shamokin, Pa. A SUBSCRIBER.

Gibson's Air-pump Puzzle.

Editor The Locomotive Engineer:

There are two conditions which will make an air-pump run as described by Mr. Gibson:

First, the reversing cylinder being so short that the cap would not hold it in place. In that case the steam would blow past the reversing cylinder, where it ought to make a joint next to the ports. Second, it will act about the same if the reversing valve cap does not make a joint on top of the reversing valve bush, allowing steam to pass over the top of the bush and down its side through the groove to the cylinder, thence through exhaust ports of upper main steam valve bush.

As to Mr. Gibson's second problem, would say that there must have been an obstruction either in the steam or exhaust pipe, notwithstanding he says the pipes were all right. I have seen exhaust pipes in smoke-arch so stopped up with cinders that the pump would not work. Exhaust pipes to air-pumps should reach to the top of smoke-arch, they would be less liable to stop up.

I did not take out main piston to examine rings, nor did I say that I did. When I got the head off, I discovered that the trouble was in the main steam valve, and of course was satisfied that the main piston rings were all right, without taking them out.

I expect to give the boys a "tough" one next month. W. F. RELYEA.

Syracuse, N. Y.

The Answer.

Editor The Locomotive Engineer:

I notice in my last air-pump puzzle a mistake I wish you would rectify. Instead of reading, "all pipes in good order," should read, "all air pipes in good order."

The answer to the first question is: The bottom of reversing valve bushing was broke, allowing it to drop down on reversing valve stem. Machinist wrapped it with tin, drove it in place, and pump worked all right. Second question: We use an exhaust pipe extending into the smoke arch and having a cap screwed over the end, and a number of small holes drilled into the pipe. These holes had become clogged up. EDWARD GIBSON.

Wilmington, Del.

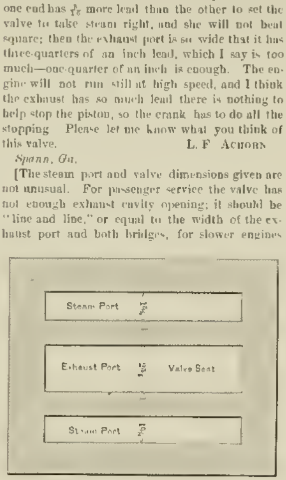
Proportion of Valve Seats and Valves.

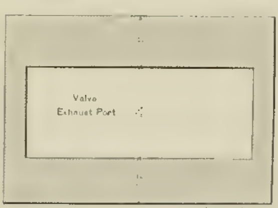
Editor The Locomotive Engineer:

Please find enclosed a sketch of a valve put in an engine by one of the large builders in this country, which they say is all right, but I think is not. I say that both ends of the valve should be the same, as both ports and bridges are alike, and then I say the exhaust port in the valve is too wide, so it gives too much lead on the exhaust. As you will see, one end has 1/16 more lead than the other to set the valve to take steam right, and she will not beat square; then the exhaust port is so wide that it has three-quarters of an inch lead, which I say is too much—one-quarter of an inch is enough. The engine will not run still at high speed, and I think the exhaust has so much lead there is nothing to help stop the piston, so the crank has to do all the stopping. Please let me know what you think of this valve. L. F. ACHORN.

Spann, Ga.

[The steam port and valve dimensions given are not unusual. For passenger service the valve has not enough exhaust cavity opening; it should be "line and line," or equal to the width of the exhaust port and both bridges, for slower engines





an inside lap of not more than a sixteenth is often used with good results. The difference between the two sides of the valve was probably made to get an even exhaust. It used to be the general practice of some builders to pay little attention to the proper proportion of lifting gear and to the point of suspension of the link, the valves were made with inside lap, and set to cut off square, regardless of the exhaust, then the wheel was quartered correctly, and the inside of the valves cut out so that the four exhausts would be even, regardless of the uniform point of release; the valves were then marked F for front, and if you got them in wrong you had a lame engine. This practice has been pretty much abandoned now for more correct methods. An indicator would be the quickest, simplest and cheapest way to find trouble with your engine's valve motion, the compression line would at once tell whether or no the crank was doing all the stopping of reciprocating parts on the centers.]

The Chain Gang from the Fireman's Point of View.

Editor The Locomotive Engineer:

I would like to say a few words about this chain gang business from a fireman's side of the question. In the go-off you are called to go on freight about two in the morning. You get on the engine, and the first thing is, "Where is the torch?" You look about five minutes, and finally locate it in the tool-box, mixed in with tools, coal, pieces of packing, dirty waste, and the Lord knows what else. Then you look at your oil cans, some full, some empty, and just about this time your torch goes out. Cause, no wicking. Put a piece of waste on packing hook (if you can find it), go out to light and fill head-light, find it empty, and about half enough oil to fill it with, and it is the same thing on every one of them. Look around and see what you can find, and if you can't find it, let it go. I have always fired a regular engine until lately, and I could go on that engine the darkest night in the year, and always find what was wanted without wasting an hour looking for tools, torches, oil, etc., and I could put a clean pair of overalls on, and they would last a few days at least; but now they are dirty before I get them unrolled. You can talk about the fireman getting rid of cleaning. Give me the regular engine, and the cleaning, too, every day in the month. I don't know how much the company makes by this deal, but I know it makes me, as a fireman, cuss a good deal. FIREMAN.

Lockport, N. Y.

De Sanno's Breakdowns.

Editor The Locomotive Engineer:

Some time ago I cited a case of broken back-driving axle, and asked the readers of THE LOCOMOTIVE ENGINEER what ideas or plans they would have for blocking up. I took out the broken axle, boxes and wedges; jacked engine up until the forward boxes were down on the binders, then blocked between back spring saddle and top of frame, which of course put a tension on the forward spring which was resting on top of frame over forward driving-box, then put block of hard wood in between top of forward driving-box and frame, then let the engine down. If she crushed the block too much, raised her up and put in a larger block, and increased the size of the block until I got a good squeeze on it, without splitting. My idea was to give the springs about all they would carry without breaking. I put the block of wood on top the forward driving-boxes to catch the engine in case the springs gave out, also to carry part of the load, but not to put the whole weight of the engine into the crown of the forward jaws. I blocked up the back springs to make the load more elastic than it would have been if I had taken out the back springs, and put a block under the back end of equalizer; but I do not claim to have taken any of the weight off the forward drivers. Felt safer to send the engine out that way than to put any of the load on the tender. Had no old wheels to put under the fire-box. Was I right or wrong?

In regard to that bad case of slipping ahead after the engine was shut off, will say, the dry pipe did collapse, and why the engine came to a halt so suddenly was caused by her breaking the right valve stem at half stroke, which shut off the outlet on that side, and when the left valve covered the ports on the left side the game was up.

That other engine that got to bucking, and would not move, her right piston, rings and springs broke into small pieces, leaving the key sticking through the end of the piston rod. A piece of the broken piston blew through and blocked up the valve, and caused the blow. Why that piston and attachments should fall to pieces so suddenly, and while working light steam, is a mystery. The cylinder did not have a scratch on the inside, and the forward head was an old repaired one, and the joint on it was not started. These strange accidents are some of the mysterious things that happen in the life of railroad men, that are not under human control, or brought about by any human agency.

Corry, Pa. W. DE SANNO.

Ambrose Webster, who is and has been for more than thirty years superintendent of the Waltham Watch Works, was once a railroad mechanic. He tells an interesting story of his experience on the Richmond & Danville road away back in '53. He jacked a locomotive up and took out her wheels without shoring up on each side and at the ends of the boiler, and got discharged for it—master mechanic said the boiler might have tipped over. If he jacked up an engine and *did* prop up the boiler now, he would probably have to take a walk just the same.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

Communications relating to the reading columns should be addressed to the Editor All other communications should be addressed .

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Standing Notices.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations*

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NEW YORK, FEBRUARY, 1891.

CONTENTS

Grievance Preventive.

Take any of the long lists of grievances presented to the operating officers of American railroads by the employes of any department or departments, and analyze them, and you will, in nine cases out of ten, find the whole formidable array composed of little things, or what at the start were little things

Partly from the disposition of the men to kick only among themselves, and partly from the overbearing manner of many officials, the men do not communicate to their officers the little annoyances of the service, but nurse them and favor them, and believe they are big and dangerous, until a pimple becomes an ulcer or a cancer. The practice of nursing little, petty annoyances until they become unbearable grievances should be discouraged and avoided by both the men and the officers over them. Nothing is better for trouble of this kind than an occasional chat with each other.

It's a pretty poor division master mechanic who don't know what is going on among the men under him, if they are dissatisfied with something he is doing, let him go out into the roundhouse and have a half hour's chat with half a dozen of them —perhaps both sides are laboring under wrong impressions. If there is an annoyance on the road the men ought to feel free to go in, on the start, and tell the master mechanic all about it; a turn of the hand, the scratch of a pen, or a word may rectify the trouble and strangle a grievance at birth.

The old idea that a railroad officer must be out of touch with the men in order to serve the company is dead wrong, and is dying with a lot of other old ideas, the best captain is the man whom the men love, who goes with them and says "come"—not him who gets behind a tree and says "go." Motive power officials who have the good of the service at heart will recognize this, and also that it is a difficult thing for one or two men to do all the talking—he should talk with them all. He should also remember that our enginemen are only beginning to shed their prejudices, and that if any one man went to him regularly, even with the sole idea of righting wrongs, he would be soon marked down as a tale-bearer—a sucker.

The M M. can get a better idea of the exigencies of the service by going over the road, riding on the engines, and putting himself in the places of the men. Where such a policy is pursued you will find more contented men, fewer grievances and less trouble It is not necessary that the master mechanic and his right bower, the traveling engineer, should take in the town, play pool or drink beer with the men—each should preserve his proper dignity and be an example to them—not *above* them, but the best man *among* them.

The officer who does the right thing among the men will soon be picked out and respected according to his acts Not because he *favors* the men, but because he is *just* to them. Not because he puts them on one side and the company on the other and then leans to their side, but because he makes the interests of each identical. Not because he assumes that the rank and file are cattle to be coaxed or driven as the case may be, but because he considers them as, at least, half human, and treats them accordingly

Prof. Marks and Dr. Bell recently delivered a lecture, or read reports, before the Franklin Institute, Philadelphia, in which they made a great many wild statements about the death and decay of the steam engine and boiler, and how electricity was going to haul all our trains, very fast, at little expense, etc. One of them stated that on a locomotive the engineer had sixty-four places to oil, and if he missed one of them disaster was the result; the motor was going to run cool, etc. We have received a number of letters on the subject from practical mechanics, but the one on another page, from R E Marks, about fills the bill.

John D Campbell, who has been general superintendent of the New York elevated roads for the past three years, and was formerly general foreman of the shops, has been appointed assistant to Wm Buchannan, Supt of M P of the N Y Central & Hudson River road. John Campbell's old friends will be glad to see him back in his element —the mechanical department Mr. Campbell's experience as a machinist and locomotive engineer dates back for more than twenty years; he has more than ordinary mechanical ability, is a splendid shop manager, an organizer, a good man to handle men, and above all is clean—he is nobody's "man." The Central road, and Mr. Buchannan in particular, are to be congratulated upon getting so able a mechanic without any "ifs" or "provided howevers" to him

Of about six hundred companies operating railroads in the United States, three hundred and seventy-seven report that they have strict rules forbidding the use of intoxicating liquors.

Book Reviews.

THE CARLISLE ACCIDENT AND THE VACUUM BRAKE. Compiled Opinions of the Press.

This is a book of 100 pages of the opinions of the principal papers of Great Britain on the brake failure that caused the fatal accident at Carlisle on the 4th of March, last year.

The book was issued, no doubt, to refute the claim made by the Vacuum Automatic Brake Co, that the accident was not caused by ice in the pipes. The author cites 214 cases where the brake has failed on account of ice in three years the instances are from the Board of Trade returns. The work does not state the name of the author or the publishers.

REPORT OF THE COMMISSIONER OF LABOR FOR 1889. DEVOTED ENTIRELY TO RAILROAD LABOR Compiled by Carroll D. Wright, Commissioner. Government Printing Office

This work is composed principally of tables of wages on different roads for all classes of employes The pay lists were made up from the actual pay-rolls of sixty different roads There is a great deal of useful information in the work on insurance and relief associations, the number of accidents, and a lot of useful matter concerning the laws in different States on the liability of employers for personal injuries to their employes. There is also a table of wages paid on roads in Great Britain. You can get a copy of this work free by requesting your congressman to procure you one.

ASKED & ANSWERED.

(10) J. D , Durham, N C , asks

Who is the inventor of sight-feed lubricator? *A* —The sight-feed lubricator was invented and patented by J. Gates, Portland, Oregon, April 29th, 1873

(11) M R B , Washington, D C , asks:

What is the size of delivery tube of No. 8 monitor injector? *A*. We suppose you mean the combining tube, which governs the size of an injector; other tubes may be varied for different service A No. 8 injector always has a combining tube eight millimeters in diameter, regardless of the make

(12) J. B Horner, Shamokin, Pa , asks:

1. Does the hooking back of the reverse lever increase the lead on the valves of a locomotive? 2 Does the automatic governor on high speed Armington & Sims engines shorten the stroke of the valve and cause the engine to have increased lead? *A* —1. Yes 2. Lead is constant Shortening the travel does not necessarily change the lead

(13) A L. Swift, Eldon, Iowa, asks:

1. At what point will the exhaust occur when an engine 18x24 is working with the reverse lever hooked up to cut off exactly at 6" of piston travel? The engine's valves are set line and line, no lead, 3/4 outside lap, 5 1/2 eccentric throw. 2. How much should the lead increase by hooking her up two "notches"? *A* —1 It is impossible to tell exactly from this data but the release should take place at about 15" of piston travel for a 6" cut off 2. That depends upon the design of the valve motion, principally the length of the eccentric blade

(14) M. R , Georgetown, D C , asks:

Why is it that the train pipe cock should be turned off on the train before the cock on tender of engine is turned, or the air will apply brakes on train? *A*. —It is only necessary when opening or closing a cock not to reduce the pressure under the train Most noticeable when taking on extra cars or coupling on a new engine; in the latter case if the train cock is turned first, enough air will expand into the hose to reduce the main line pressure enough to set the brake; if you open the tender cock first, the hose is filled from the engine drum, and when the train cock is opened no reduction takes place

(15) C P C., Frisco Line, asks

Do you believe a 15"x1 1/4" steam port will give sufficient port opening to an 18 cylinder, cutting off close at high speed, even though engine may have 5 1/2" valve travel. *A* —There is a great difference of opinion on this subject In average American practice the length of port is short for high-speed engines. It is ample for the steam to get in at, but a large opening is needed for the exhausted steam to get out There are many reasons why a port should be kept as short as possible, and some of the fastest locomotives in the world have ports as small, or smaller in proportion to cylinder, than the size stated

(16) Elevated Fireman, N. Y., asks:

Will you kindly inform me why vacuum is read in inches and steam in pounds? *A.*—Vacuum could be expressed in pounds or steam in inches, but it has been customary, and still is in some countries, to express pressures in "atmospheres"—the pressure of the atmosphere is 14.7 pounds per square inch. Vacuum is always less than one atmosphere, and it was easy to express vacuum in fractions of atmospheric pressure. If you had a U shaped glass partly filled with mercury, one end open to the air and the other connected to some vacuum-producing device, for every pound of pressure that the device took out of its end the mercury would rise two inches in the loop until there was 30 inches more in the connected end of the tube than in the open one, when a practically perfect vacuum would be obtained. An inch of vacuum means, practically, a half pound of pressure.

(17) Frisco., Monett, Mo., writes:

We have a class of engines that ride very hard, working at short cut off and running fast. Some of the boys believe it to be in the counterbalance. Others think it is owing to excessive compression. These engines ride hard only when working under the conditions named. We have another class that do not develop this trait, even with the most inside lap. We have decided to ask your opinion in regard to it. *A.*—The hard riding is probably caused by excessive compression at short cut-off; if these engines ride easy at high speed running down hill shut off, it would help to prove that the counterbalance was not guilty. The engines with the inside lap would have greater compression under ordinary circumstances. There may be a difference of outside lap that is responsible for the extra compression, or other conditions might cause a derangement of the steam admission or release. The hard riding engines may have more or less clearance, different motion, or other chances to cause pounding.

(18) C., Monett, Mo., writes:

Give a concise description of the steam reverse gear, as applied on the P. R. R. *A.*—The reach rod is connected to the piston rod of a pair of small horizontal cylinders placed just ahead of the cab, the rod extending through both cylinders just as it does in an air-pump. One cylinder is for steam, and the admission of pressure to either side moves the piston rod and the reach and tumbling shaft in the direction desired by the runner. The second cylinder contains oil on both sides of the piston, the cylinder being kept entirely full; from one end of the cylinder to the other there is a connecting port that is closed by a plug valve; this valve is so connected to the steam handle that when the latter is moved either way from a central point it opens communication between the two ends of the oil cylinder, and the pressure of the steam forces the oil from one end, through the port, to the other. When the steam valve is brought to a central point steam is shut off and the plug in the oil passage closed; the oil then holds the piston and its attachments in position. The steam cylinder takes the place of the engineer's muscles, the oil cylinder takes the place of the quadrant and the latch. Don't make one of them; the P. R. R. are taking them off, and you can probably get your pick of the pile at Altoona, Pa., for a small consideration.

(19) Young Runner, Durham, N. C., writes:

I have been running an engine with an old style No. 7 Sellers injector, that will not work at a pressure of 130 lbs. of steam, but will readily work at a pressure of 75 lbs. My idea is just this: The tubes in the injector are, from the use of impure water, nearly filled up with incrustation or sediment from this water. Please let me know if my idea is correct. *A.*—What causes the trouble with your injector depends upon what style it is. It may be an old Gifford, an old style (1867) Sellers, or the "76", and "circumstances" govern cases. Assuming that it is an old-style (1867) device the trouble probably arises in this way. This injector was arranged so that the discharge tube moved through a bushing between the overflow chamber and the overflow valve, which was located ahead of the discharge tube; this bushing and discharge tube would become worn by use so the water, after leaving the discharge tube, would pass back into the overflow chamber with sufficient pressure to push the combining tube back against the steam tube and shut off the supply of water, which will, of course, cause the injector to stop working. The reason that it will work at 75 lbs., and not at 130, is that there is less pressure, and the leak at that is taken up and carried through the discharge tube, but when the 130 is there the leak is so much it cannot be all taken in at overflow; the longer it is used the more it will leak and the lower pressure it will work at. If it is any other style of instrument, state what it is.

The very able paper on Air-brake Rigging, by R. A. Parke, M. E., read before the New York Railroad Club, has been issued in pamphlet form. The article is worth a dollar of any railroad man's money, but you can secure a copy free by sending a stamp to Secretary N. Y. Railroad Club, 28 W. Thirtieth street, New York.

The firm name of the Baldwin Locomotive Works has been changed from Burnham, Parry, Williams & Co., to Burnham, Williams & Co. The new shops and new tools added during the past year have increased their annual capacity to above 1,000 finished locomotives. More than double the capacity of any other works on earth.

The Chicago Shops of the Rock Island Road.

[*Editorial Correspondence.*]

The Chicago, Rock Island & Pacific line reaches from Chicago to Colorado Springs, Colorado, a distance of over 1,000 miles, besides many branches, bringing up a total of 3,257 miles owned and leased, which includes the Chicago, Kansas & Nebraska. They are running on all the lines upward of 500 locomotives, and over 10,000 cars.

THE MAIN SHOPS

are located at Chicago, but the new shops of the Western line, located at Horton, Kansas, are said to be the better shops on account of the equipment being new. The Chicago shops are located between 47th and 52d streets, and occupy a large and valuable tract of land in the windy city.

THE BUILDINGS

are of white brick built some twenty years ago, but have been well kept up, and were especially well constructed in the first place. The yards are tidy and neat, but not embellished by landscape gardens—but you don't care much about the shops; you want to know what they contain that is of interest.

THE MACHINE SHOP

adjoins the office, and is of the usual one story design, having the pits on one side and the machine tools on the other, the latter arranged so as to handle material as little as possible. There were twelve or fourteen engines on the pits for general repairs at the time of my visit, and they are also building six new 18x24 8-wheelers—they have just completed six others, and very handsome machines they are.

ROCK ISLAND ENGINES

have for years been remarkable for certain peculiarities, and were unlike anything in the country. The idea of Mr. Twombly, who for years was at the head of this department, was to make a locomotive with as little machine work as possible, thus cheapening the machine. Mr. Wilson has followed out the idea of cheapening parts, but has made his engines look more like standard machines.

CAST-IRON

has been used for many parts, and forgings, nicely made and painted, take the place of much expensive machine finished work.

THE TWOMBLY ENGINES

all had straight boilers, and the first peculiarity you noticed was that the back head was held in by a double row of rivets, while all other seams had but a single row. Then the throttle was located in the smoke-arch, using a large, open dry pipe, the bell crank arrangement was located back of the stack on a rather cumbersome cast-iron frame, from which a rod ran along the left side of the boiler, above the running board, to the cab, the throttle lever reaching entirely across the boiler head to connect with it. When one of these engines stands for any length of time, water collects in the dry pipe, making them disagreeable to handle.

Long years ago the men named the throttle frame back of the stack the "turkey-roost," and this style of throttle was known among them by that name.

CAST-IRON ROCKERS

have been used here for many years, and with perfect success. With cast iron there is no chance to bend or spring, and a new one can be made for less than it costs to straighten a wrought-iron one that has been bent. The old engines here had a rather small rocker, and a crooked one at that, yet they had no trouble with them. Cast-iron guides were also used.

WROUGHT-IRON PARTS,

such as the rods, eccentric blades, valve stem rods, etc., were only machined where they came in contact with other pieces. The valve rod has only the hole drilled in each end, the keyhole for valve stem, and the sides of the back boss turned off; the rod itself is rough and painted. Side and main rods are the same, the eccentric blades having only the ends finished, the link hangers the same.

Some of the old engines had a long reverse lever, and the reach rod running from the lower end along the side of the ash-pan to the arm of the tumbling shaft, which was straight and extended down.

THE DRIVING-BOXES

had strips of brass cast into them, which made a cheap construction, but they gave trouble by getting loose, and in cutting.

THE CHEAPEST ENGINE TRUCK

I have ever seen is made here, and has given satisfaction for years. They use only a 24 inch truck wheel, which is pretty small. The truck is of the floating-box style; the pedestal jaws are cast-iron, the wearing faces of which are chilled, the top, where it is bolted to the frame, being the only place planed. The sides of the box are cast against chills, and it has no machine work on it at all; the cellars are cast neatly, and go into the box right from the foundry. The top frames are simply two pieces of flat iron cut off to the proper length, placed together and drilled. The truck is a rigid one, having a cast-iron center, which, of course, admits of cheap frame construction that could not be used in a swing truck. The brasses are cast, the sand taken off the face roughly on an emery wheel, and lead lined. No reamer is used in any holes, turned bolts are driven into well-drilled ones, and no fine work is expended on them. These trucks have given such good satisfaction for years, and have cost so little for repairs, that Mr. Wilson uses them for his best engines, his only improvement being in the use of a steel tired wheel, he has used some Allen wheels, but the new ones have the Boies steel wheel. On the inside of the cellars of this truck they place a piece of $\frac{3}{16}$ sheet-iron that is cut out to fit the axle, it is held up in front by a small tap bolt into the cellar casting, at the back there is another tap bolt through a slot in the strip, this admits of raising the strip as the brass wears away and drops the cellar away from the journal, and serves to keep out dirt, and keep the packing in.

THE NEW ENGINES

are something to be proud of, both in design and workmanship. They have a splendid wagon top boiler, and the design conforms more to the style of well-known builders. Cast-iron Laird guides are used, cast-steel rockers and the wrought parts are painted instead of finished, but they are so neatly forged that at twenty feet distance an expert would not note the difference. They have extensions and straight stacks.

BUSHINGS.

Everything that is subject to wear is bushed, rods, link motion, tumbling shaft arms, etc. The plan is to do little machine work on these engines during future repairs. The tumbling shaft has a bush on each end held by a set-screw, and the box has a bush as well. The tumbling shaft ends can be made true in ten minutes by simply changing bushes, and it need never see a lathe.

BALANCED VALVES

designed in the shop, with two sets of round packings on top, are used; the valves are enormously heavy, and one would think that they would jerk the valve stems off, yet the new engines have got up to more than sixty-five miles per hour without trouble.

These engines are 18x24 with a 62-inch wheel center.

THE FOUNDRY

is rented to a firm of contractors, who do the company's work by the pound. The use of a foundry is of great help to a shop, and many kinds of work and many cheap processes are rendered possible by its use, that are out of the reach of the shop without one. One pit in the shop has a good drop table, there are racks between pits for the different parts of stripped engines. The shop is roomy, there are cranes where needed most, the light is good and the place clean.

A NEW SCHEME

In the rod gang's place we noticed a self-adjusting main rod brass scheme that is being made for trial under the direction of the inventor. This consists of a heavy eccentric located between the brass and the rod end, with provisions for turning it, and holding it when turned. The inventor says they will start with the brasses $\frac{1}{16}$th open. It looks as if he would soon have the brasses hopelessly loose in the strap—it has been in use some time on stationary engines. Some of the different classes of work are under the care of a foreman, thus all the tire, pin, axle and other driving-wheel work are seen after by one man. E. Eich is foreman of machines, and C. E. Trenton foreman of the pits.

THE BOILER SHOP

is under the care of our correspondent, Jas. Heron, who seems to be the right man in the right place. He has been in charge but a few weeks, but has already introduced changes and improved methods wonderfully. Heron is one of the few boiler makers who do not have to have a wooden template designed in the drawing-room for every piece he makes. He lays off each piece when it is flat, and punches every hole that goes into it before it is bent or flanged. On some back heads they were punching when I was there, I noticed even the gauge-cock holes were punched as well as those for other attachments, and the mud ring, this is not usual.

SYSTEM.

The plates for an entire boiler are brought in on a large push car, rather high, one sheet on top of another; the foreman lays them off, and as they are finished they are lifted to another car or by a crane or trolley, and the first one is punched long before the last one is laid off.

Mr. Heron has a system of templates—that's what he calls them—that are simply long steel straight-edges drilled full of holes. With these and a pair of dividers he lays out a complete boiler. He will explain it all to you if you go there, but I can't explain it. (Heron has promised to do so soon.)

All irregular-shaped sheets are trimmed with a punch; shears are not used. The punch is one of Mr. Heron's own make—a design he has used for some years.

THE PUNCH

is shown in the sketches herewith, and is oblong, seven-eighths of an inch wide and two inches long. A side view of the tool is given in cut marked "front," and, as will be seen, there is a round bit at one end that does not come out of the die while at work. The tool is started from the edge, or from any hole large enough to admit the "tit," and this acts as a guide to the work. Fig. 3 shows how the work can be turned under the tool, making a round or square turn, an obtuse or an acute angle. This cut also shows the form of the punchings.

With this punch they cut out the back heads, flue sheets, throat plates, etc., and it leaves a smooth edge that needs no other trimming. While I was there they cut out a back head in eighteen minutes.

One of the greatest advantages of the punch is that it leaves both pieces straight and flat, the outside pieces being useful for patches. This tool can be used in any punch that is strong enough for the work, and it does such nice work that, if tried, you will never again use a round punch for dome holes, etc.

ANGLE IRON SHEAR.

Boiler makers who have much tender and ash-pan work to do know what trouble and annoyance the cutting of angle irons by hand is. Mr. Heron does this work with a shear, and the ends look as if they had been sawed. This tool is here shown by rough sketch. The point of the tool strikes the iron first, using all the power of the machine to cut the heavy part in the corner.

LARGE ROLLS.

They have a new set of heavy rolls, made by a well-known maker, that we have had occasion to criticise before, not on general principles, but because of little faults that detract from their usefulness. Railroad shops, as a rule, cannot afford more than one set of rolls, and these should be adapted to every variety of work they have to do. This make of rolls will not close together enough to permit of the rolling of a smoke-stack, roundhouse jack or any such work of thin iron. The operating levers are so arranged that one man cannot handle them without moving, and the tilting screw frame is so heavy that in an accidental starting of the lowering gear recently the tail of the top roll was badly bent. In most rolls this screw is only held by a couple of long bolts, that would break long before the massive roll tail could get a four-inch crook in it—a case where a device is made too good.

ATTACHMENTS TO HYDRAULIC RIVETER.

At the end of the shop there is a tower and crane for handling work for the big riveter. When I was there they were using the riveter for a punch, and a very good one it made, being able to get to the center of a very large sheet. They are building a little attachment for this machine, for reaming or drilling out holes. It will be very useful, especially in repair work, to clear out bruised holes or those that do not come exactly fair.

FLANGING FORMS

of cast-iron are used, and so constructed that the crane does not have to let loose of a piece that is being flanged, and the entire flange is turned at a single heat. It is an advantage in heating a sheet, say the back head, to have it punched first, as the fire goes through the holes and gets the whole sheet hot evenly, while with a blank sheet the edges are burning before the center of the sheet is half hot enough.

THE BLACKSMITH SHOP

is a very large one, and under the charge of another ingenious mechanic, in the person of Mr. Geo. Tutbury. This gentleman does more and heavier work on his "bulldozer" than any one I have yet seen. The formers used for this work are kept in a storeroom of their own, and are very ingenious.

Some of the heaviest work they do are equalizers for floating box trucks. These are about five feet long, an inch thick, and five and a half wide. They are bent edgewise, and done very neatly. They are kept from buckling by lips on the opposite sides of the two jaws of the former.

An endless variety of car irons are bent up here and punched. Handles for Janney couplers, having four bends are made by the hundreds; draw-head yokes, very heavy, are formed, and brake beam hangers, with several bends, are made four at a time.

Nosing irons of one-sixteenth inch stuff, bent at a very sharp angle for the edges of unloading boards on stations, were formerly heated and bent by hand at an expense of fifty cents each, are made now on the machine, cold, at a cost of a cent or two each for labor. Heavy keyholes in draw-bar bolts are punched on the bulldozer by clamping them between dies that leave an opening just large enough for the punch.

The usefulness of the bulldozer would be very much enhanced if the builder would make the frame a little deeper at the back end. Even light work that is high has a tendency to tip over, making it very hard to do accurate work, and rendering some otherwise simple jobs impossible.

NO LARGE STEAM HAMMER

is used, but a heavy steam helve hammer takes its place. It does good work for a tool of its kind, but a direct steam hammer would be far better.

A GAS FURNACE

for heating iron for the formers is in use, and a very neat device it is, doing away with the smoke and dirt of several large fires.

THE TIN SHOP

is located over the machine shop in a gallery, and is well supplied with tools. In one corner I noticed a pile of several hundred signal lamps for switches, etc., a class that have been discarded. In the shop there were piles of neat malleable iron castings of the bodies of new four-light lamps. In this tin shop they were making a lot of copper wire steam chest joints, and putting them together in a way that was, to me at least, new. Instead of cutting the ends at an angle the ends were left square and a slit sawed into each end for about a quarter of an inch, and a little piece of copper sheet slipped into the slits. This brings the ends up fair and a smart tap with a hammer holds the ends solid while being brazed.

EXTREMES MEET.

A person originally designed by Providence for a clown, as I was, can't go around a place like this without seeing something that strikes him as comical. I was looking for it—just as a boy with new boots hunts a mud puddle—and found it in the tool-room. General Foreman Black had just been showing me their truck and how they cheapened work by making paint take the place of polish, and had me all enthused with the subject and its details when we stepped into the tool-room. The gear cutter was at work on a pile of nice castings of spur and pinion wheels *for hand cars*—think of it! The road commenced this practice years ago, before cast gears were as good and cheap as they are now, and the roadmaster still insists on cut gears.

THE CAR SHOPS

are very extensive, and are well fitted up. They are under the supervision of Mr. B. K. Verbryck, Gen'l M. C. B., ably assisted by Sam'l Pullman, M. C. B., in immediate charge. They have a very neat and efficient iron-clad storehouse for paints with the oils located in the cellar. There seems to be plenty of room and good facilities.

I noticed an 80-foot sleeper in the paint shop, that would not have let the doors shut if there had been another coat of paint on the draw heads.

The cars are painted better and more pains taken with the ornamentation than usually seen. Mr. John Rattenbury is the master car painter, and some of the handsomest work I have ever seen is the pearl inlaid pictures of locomotives and cars turned out under him as advertisements for the road—they are works of art.

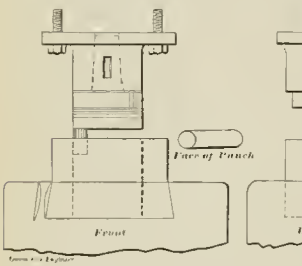
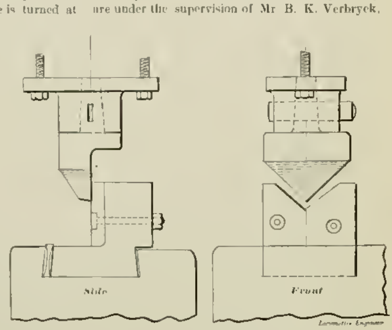


FIG. 3.



THE ROUNDHOUSE

is under the care of an old runner, E. W. Kenyon. The house is a modern one, where the engines head in, and is about like other roundhouses. They use here a cast-iron smoke-jack that lasts about five times as long as a sheet metal one.

A POINT.

In this shop they put their extensions on in one piece, and in putting in a new boiler the front end is not riveted to the boiler. It is otherwise finished and is then fitted to the cylinders and fastened there, giving the men more room and time to work. When they are ready for the boiler they set it on, slip the joints together, and rivet it fast.

AIR ENGINES

Small, compact oscillating engines are used for driving cylinder borers, etc. Air is supplied by two brake pumps located in the boiler house. There was a Westinghouse and a New York pump side and side. Starting at nothing, the Westinghouse pump would fill the large drum to working pressure in twelve minutes. The New York pump took twenty four minutes to do the same work. G. F. Wilson, Sup't of Motive Power, and General Foreman John Black have little to be ashamed of and much to be proud of in this shop; it is above the average. J. A. H.

The Newport News & Mississippi Valley lost a locomotive and an engineer on January 8th by the explosion of the boiler. Inspect.

The Clean Man and the Dirty Angels.

BY JOHN ALEXANDER

When I first went firing, down in my native district, where Bean is king, there was a man on the road pulling a mixed train, by the name of Clark—'Lige Clark.

Being only a fireman, and a new one at that, I did not come very much in contact with Clark, or any of the other engineers, excepting my own—James Dillon, whose story I have told you.

'Lige Clark was a character on the road, everybody knew "old 'Lige"; he was liked and respected, but not loved, he was thought puritanical, or religious, or cranky, by some, yet no one hated him, or even had a strong dislike for him.

His honesty and straightforwardness were proverbial. He was always in charge of the funds of every order he belonged to, as well as of the Sunday-school and the church.

He was truthful to a fault, but, above all, just.

"'Cause 'tain't right, that's why," was his way of refusing to do a thing, and his argument against others doing it.

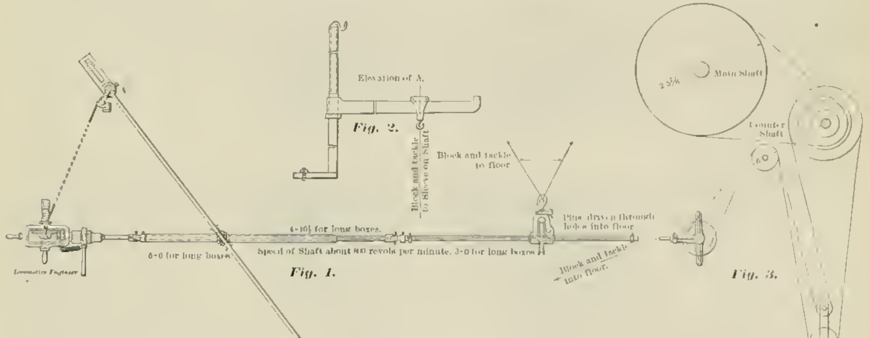
After I got to running I saw and knew more of 'Lige, and I think, perhaps, I was as much of a friend as he ever had. We never were chums. I never went to his house, nor he to mine, we were simply roundhouse acquaintances, used to talk engine a little, but usually talked about children—'Lige had four, and always spoke of "doing the right thing by 'em."

he always got up and said: "Them air declarations ain't right, an' I wouldn't ask any railroad to grant 'em", or, "The declarations are right; of course I'll be glad to take 'em."

When old 'Lige declined to hear a grievance it was modified or abandoned, and he never took a request to headquarters that was not granted—until the strike of '77.

When the war broke out 'Lige was asked to go, and the railroad boys wanted him to be captain of a company of them, but he declined, saying that slavery was wrong and should be crushed, but that he had a sickly wife and four small children depending on his daily toil for bread, and it wouldn't be right to leave 'em unprovided for. They drafted him later, but he still said it "wa'n't right" for him to go, and he paid for a substitute. But three months later his father-in-law died, up in the country somewhere, and left his wife some three thousand dollars, and 'Lige enlisted the next day, saying, "'Tain't right for any man to stay that can be spared, slavery ain't right—it must be stopped." He served as a private until it was stopped.

Shortly after the war, 'Lige was pulling the superintendent over the road, when he struck a wagon, killing the driver, who was a farmer, and hurting his wife. The woman afterward sued the road, and 'Lige was called as a witness for the company. He surprised everybody by stating that the accident was caused by mismanagement of the road, and explained as follows: "I pull the regu-



SCREW-STAY TAPPING MACHINE.

Screw-stay Tapping Machine.

At the Montreal shops of the Canadian Pacific they use a very efficient home-made machine for reaming and tapping out holes for stay bolts.

The machine was designed to reduce the delays and annoyance from breakage of flexible shafts.

Our engraving shows at the right, Fig. 3, the arrangement of the rope-driving device, which is a very good one, giving the operator plenty of "go-and-come." This is, however, independent of the machine.

The slip joint in the center of the machine is supported by a trolley on the swinging arm of a small crane, as shown at *A*, and also in Fig. 2, the drill head, shown at the left, being supported by a cord attached to a weight and suspended in a small sheave hung in the hook on top of the crane.

The drill head is geared as shown, and has convenient handles for its manipulation. There is also a small clutch that enables the operator to stop and start the drill at pleasure without shifting belts or disturbing the driving gear.

The outer end of the knuckled driving rod carries the driving pulley, which is made fast to the floor by a small tackle, the tension of the driving rope and weight keeping it up.

With one setting the boiler maker can tap all the holes in the side sheets of a boiler. This machine runs at a high speed, and does very fast work.

We have received numerous letters on the air pump question since the publication of the answer, which, of course, we cannot use.

'Lige had a very heavy, full beard, that came clear up to his eyes, and a mass of wavy hair—all iron gray. His eyes were steel gray, and he had a habit of looking straight at you when he spoke.

On his engine he invariably ran with his head out of the side window, rain or shine, and always bareheaded. When he stepped upon the footboard he put his hat away with his clothes, and there it stayed. He was never known to wear a cap, except in the coldest weather.

Once in a while, when I was firing, I have seen him come in, in winter, with his beard white with frost and ice, and some smoke-shoveling wit would dub him Santa Claus.

'Lige had a way of looking straight ahead and thinking of his work, and, after he got to running express, would go through a town, where other trains were side-tracked for him, looking at the track ahead, and at the trains, but never seeming to care that they were there, never nodding or waving a hand. Once in a while he would blink his eyes, that was all. The wind tossed his mane and hair, and made him look for all the world like a lion, who looks at, but appears to care nothing for the crowd around his den. Some one noticed the comparison, and dubbed him "The Lion," and the name clung to him. He was spoken of as "Old 'Lige, the Lion." Just why he was called old I don't know, he was little more than forty then.

When the men on the road had any grievances they always asked 'Lige to "go and see the old man." 'Lige always went to lodge and to meetings of the men, but was never known to speak. When the demands were drawn up and presented to him,

lar Atlantic express, and should have been at the crossing where the accident occurred an hour later than I was; but Mr. Doe, our superintendent, wanted to come over the road with his special car, and took my engine to pull him, leaving a freight engine to bring in the express. Mr. Doe could have rode on the regular train, or he could have had his car put into the train, instead of putting the company to the expense of hauling a special, and kept the patrons of the road from poor and slow service. We ran faster than there was any use of, and Mr. Doe went home when he got in, showing that there was no urgent call for his presence at this end of the line. If there had been no extra train on the road this farmer would not have been killed; 'twa'n't right."

The widow got pretty heavy damages, and the superintendent tried to discharge 'Lige. But 'Lige said "'twa'n't right," and the men on the road, the patrons, and even the president agreed with him; so the irate super. gave the job up for the time being.

A couple of weeks after this, I went to the super.'s office on some business, and had to wait in the outer office until his Grace got through with some one else. The transom over the door to the Holy of Holies was open, and I heard the well-known voice of 'Lige, the Lion.

"Now, there's another matter, Mr. Doe, that perhaps you'll say is none of my business, but 'tain't right, and I'm going to speak about it.

You're hanging around the yards, and standing in the shadows of cars and buildings half the night, watching employes. You've discharged several yard men, and I want to tell you that a lot of the roughest of them are laying for you My advice to you is to go home from the office They'll hurt you yet. 'Tain't right for one man to know another is in danger without warning him, so I've done it, 'twouldn't be right for them to hurt you You are not particularly hunting them, *but me;* but you won't catch me."

Mr. Doe assured the Lion that he could take care of himself, and two nights later got sand-bagged, and had about half his ribs kicked loose, over back of the scale house.

When the trouble commenced in '77, old 'Lige refused to take a request for an increase of pay up to headquarters; said the road could afford to keep us just where we were, which was more than some were doing, and 'twan't right to ask for more. Two months later they cut us 10 per cent., and offered to pay half script. Old 'Lige said that 'twan't right, and he'd strike afore he'd stand it; and in the end we all struck.

The fourth day after the strike commenced I met 'Lige, and he asked me where I was going to hunt work I told him I was going back when we won. He laughed, and said that there wan't much danger of any of us going back, we were beat, mail trains all running, etc. "'Tain't right, Brother John, to loaf longer'n you can help. I'm going out West to-morrer"—and he went.

Some weeks afterward, Joe Johnson and I concluded that, contrary to all precedent, the road was going to run without us, and we also went West, but by that time the country was full of men just like us.

When I did get a job it was drying sand away out to the front on one of the big roads. The first engine that came up to the sandhouse had a familiar look, even with a boot leg stack that was fearfully and wonderfully made There was a shaggy head sticking out of the side window, and two cool gray eyes blinked at me, but didn't seem to see me; yet a cheery voice from under the beard said, "Hello! Brother John, you're late, but guess you'll catch on pretty quick There's lots of 'em here that don't know nothin' about railroading, as far as I can see, and they are runnin' engines, too. 'Tain't right."

The little town was booming, and 'Lige invested in lots, and became interested in many schemes to benefit the place and make money. He had been a widower for some years, and with one exception his children were doing for themselves, and that one was with his sister, and well cared for. 'Lige had considerable means, and he brought it all West. He personally laid the corner stone of the court-house, subscribed more than any other workingman to the first church, and was treasurer of half the institutions in the village He ought to have quit the road, but he wouldn't, but did compromise by taking an easy run on a branch

'Lige was behind a benevolent scheme to build an hospital, to be under the auspices of the church society, and to it devoted not a little time and energy.

When the constitution and by-laws of the institution were drawn up, the more liberal of the trustees struck a snag in old 'Lige He was bound that the hospital should not harbor persons under the influence of liquor, or prostitutes 'Lige was very bitter against prostitution. "It is the curse of civilization," he often said. "Prostitutes ruin ten men where whisky does one. They stand in the path of every young man in the country, gilded tempters of virtue, honesty and manhood; 'tain't right that they should be allowed in the country."

If you attributed their existence to man's passions, inhumanity and cruelty, or woman's weakness, he checked you at once.

"Every woman that becomes a crooked woman does so from choice; she needn't be if she didn't want to. The way to stop prostitution is for every honest man and woman to refuse to have anything to do with them in any way, or with those who do recognize them. 'Tain't right."

In this matter 'Lige Clark had no sympathy nor charity. "'Twan't right"; that settled it, as far as he went.

The ladies of the church sided with old 'Lige in his stand on the hospital board, but the other two men wanted the doors of the institution to be opened to all in need of medical attention and care, regardless of who they were or what caused their ailment. 'Lige gave in on the whisky, but stood out resolutely against the soiled doves, and so matters stood until midwinter.

Half the women in the town were outcasts of society—two dance-houses were in full blast—and 'Lige soon became known to them and their friends as "The prophet Elijah, second edition."

The mining town over the hills at the end of 'Lige's branch was booming, too, and wanted to be the county seat. It had its church, dance-halls, etc., and the discovery of coal within a few miles bid fair to make it a formidable rival

The boom called for more power, and I went over there to pull freight, and 'Lige pulled passengers only. Then they put more coaches on his train, and put my engine on to help him, thus saving a crew's wages. Passenger service increased steadily until a big snow-slide in one of the gulches shut up the road. I'll never forget that slide.

It happened on the 26th of January. 'Lige and I were double heading on nine coaches of passengers, and when on a heavy grade in Alder gulch, a slide of snow started from far up the mountain side, swept over the track just ahead of us, carrying rocks, trees, telegraph poles and the track with it We tried to stop, but 'Lige's engine got into it, and was carried sideways down some fifty or sixty feet. Mine contented herself with simply turning over, without hurting myself or fireman—much to my satisfaction.

'Lige fared worse. His reverse lever caught in his clothing, and before he could get loose the engine had stopped, on her side, with 'Lige's feet and legs under her. He was not badly hurt, except for the scalding water that poured upon him. As soon as we could see him the firemen and I got hold of him, and forcibly pulled him out of the wreck. His limbs were awfully burned—cooked would be nearer the word

The passengers crowded around, but did little good. One look was enough for most of them. There were ten or twelve women in the cars. They came out slowly, and stood timidly away from the hissing boilers, with one exception. This one came at once to the injured man, sat down in the snow, took his head in her lap, and taking a flask of liquor from her ulster pocket, gave poor 'Lige some with a little snow.

I got the oil can and poured oil over the burned parts to keep the air from them; we needed bandages, and I asked the ladies if they had anything we could use for the purpose. One young girl offered a handkerchief and another a shawl, but, before they were accepted, the cool woman holding 'Lige's head got up quickly, laying his head down tenderly on the snow, and without a word or attempt to get out of sight pulled up her dress, and in a second kicked out two white skirts, and sat down again to cool 'Lige's brow That woman attended 'Lige like a guardian angel until we got back to town late that afternoon; the hospital was not in shape yet, so 'Lige was taken to the rather dreary and homeless quarters of the hotel

As quick as it was known that Elijah Clark was hurt he had plenty of friends, male and female, who came to take care of him, but the woman who helped him live at the start was seen no more; yet every day there were dainty viands, wine or books left at the house for him—but pains were taken to let no one know from whom they came.

One day a month after the accident I sat beside 'Lige's bed, when he told me that he was anticipating quite a discussion there in the evening, as the hospital committee were going to meet to decide on the rules of the institutions. "Wilcox and Gorman are set to open the house to those who have no part in our work and no sympathy with Christian institutions, and tain't right," said he. "Brother John, you can't do good by prolonging the life of a brazen woman bent on vice."

"Don't you think, Lige," says I, "that you are a little hard on an unfortunate class of humanity, who, in nine cases in ten, are the victims of others' wrong doing, and stay in the mire because no hand is extended to help them out? Think of the woman of Samaria."

"They are as a coiled serpent in the pathway of mankind, Brother John, fascinating, but poisonous There can be no good in one of these creatures."

"Oh, yes, there is, I'm sure," said I "Why, 'Lige, don't you know who the woman was that gave you brandy, held your head, and used her skirts for bandages when you were hurt?"

Old 'Lige raised up on his elbow, all eagerness "No, John, I don't, but she wan't one of them. She was too tender, too thoughtful, too womanly. I've blessed her from that day to this, and, though I don't know it, I think she has sent me all these wines and fruits. She saved my life. Who is she, do you know?"

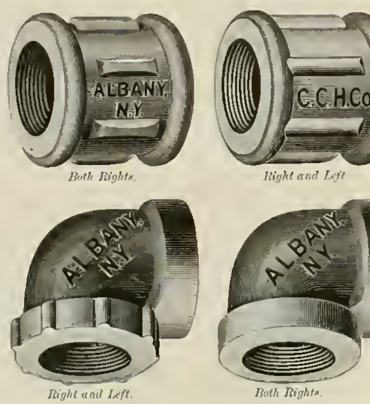
"Yes. She is Mollie May, who keeps the largest dance house in Cascade City. She makes lots of money, but spends it all in charity; there has never been a human being buried by the town since she has been there. Mollie May is a ministering angel to the poor and the sick, but a bird of prey to those who wish to dissipate."

The hospital was opened on Easter, and the first patient was a poor consumptive girl, but lately an inmate of the Red-light dance house

'Lige Clark did not run again; he became mayor of the little city, had faith in its future, invested his money in land, and died rich four years ago.

'Lige must have changed his mind as he grew older, or at least abandoned the idea that to crush out a wrong you should push it from all sides, and thus compress and intensify it at the heart, and come to the conclusion that the right way is to get on the inside and push out, thus separating and dissolving it. For before me lies the second annual prospectus of a now noted institution in one of the great cities of the continent, and on its title page I read, through the dimmed glasses of my spectacles

"Industrial Home and Refuge for Fallen Women. Founded by Elijah Clark. Mary E. May, Matron."



Both Rights. *Right and Left.*

Right and Left. *Both Rights.*

THREAD INDICATORS.

Thread Indicators.

The pipe fittings of the Consolidated Car Heating Company, of Albany, N. Y., are the heaviest and best we remember to have seen. They have a very neat way of designating right and left hand threads that would seem worthy of a more general adoption. The distinction between right and left-hand threads is made by casting ribs on the body of the fitting. Where these ribs stop short of the end it indicates a right-hand thread, where they extend to the end they indicate left-hand threads. Our illustrations explain themselves.

Air Ships versus Railways.

The last and present generations have been so prolific in producing scientific and mechanical revolutions that an incredulous age is becoming credulous, and probability has become a synonym for possibility. This is evidenced by the large area of space which the daily papers are giving up to speculative articles regarding the "Mount Carmel air ship," a model of which is now in a promising condition at the exposition building in Chicago. Whether the promises will ever be fulfilled or not is problematic, but then, so is the air ship. The inflated character of this aerated vessel and of the capital stock of its company—a mere \$20,000,000—indicate beyond peradventure that one or the other will go up, but whether the ship or the company is a matter of painful uncertainty. The pathetic cry of the inventor and promoter, that the railways looked down upon him and did all they could to hamper his efforts through professional jealousy, may be changed to a taunt of triumph when he looks down upon the railways from his private supermundane train, flying over the first and only genuine air line in existence.

It must be confessed that the local railway men are at least curious regarding the Mount Carmel air ship, although hope deferred has made them somewhat skeptical. There is a tantalizing fascination in dreaming of something which will deliver them from the self-assumed powers of granger legislators and the exuberant follies of an ephemeral Farmer's Alliance, so that the inventor of the air ship is in error when he cries against railway prejudices. Railway managers are really prepared to hail him as their Moses, *if* his air ship will run on scheduled time and demonstrate that roadbeds, bridges, ties, rails, switches, crossings and many other annoying and forever failing characteristics of mundane railways are unnecessary.—*Railway Age.*

The Semaphore signal was adopted from the English, but our American railroads were too stingy to buy decent sized lamps for night work. Signal lamps ought to be large and bright, a plain lens is better than a corrugated one, and a lamp of decent size with a chimney will give about four times the light the common 4 inch glowworm in common use does. The English signal, with its seven and eight inch lens, puts our measley little nuisances to shame. The prevailing price for little, no good, lamps is about what ought to be invested in the lenses alone.

An Austrian railroad, having two branches partly completed, whose present terminal stations have no turntables, applied to the government authorities for permission to haul freight trains on these branches with the locomotive reversed—tender ahead—which is forbidden by the government regulations. Permission was granted on condition that the speed prescribed in the time-tables should not be exceeded, and that a trainman be posted on the tender at the head of the train, to watch the track and the signals.—*Ex.*

One of the managers of a great watch manufacturing concern recently made a careful estimate of the number of watches required on railroads in New England, and finds that it averages ten watches per mile of road. This proportion would probably remain true of the eastern States but in the central and western it would fall below.

An elevated railroad engine on the Third Avenue line in this city was thrown off the structure into the street, on Sunday, the 11th. The crew jumped upon the structure and avoided the fall, no one was hurt. The accident was caused by a collision at a cross-over switch.

We will give \$2 for a complete copy of the third annual report of the American Railway Master Mechanics Association.

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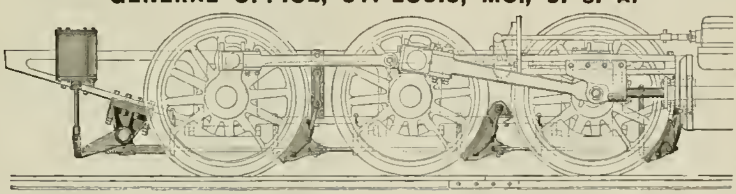

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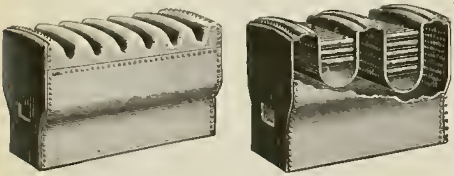

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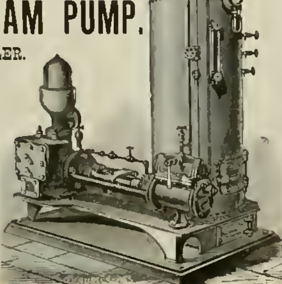

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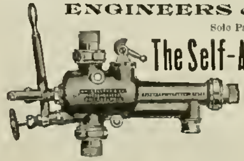

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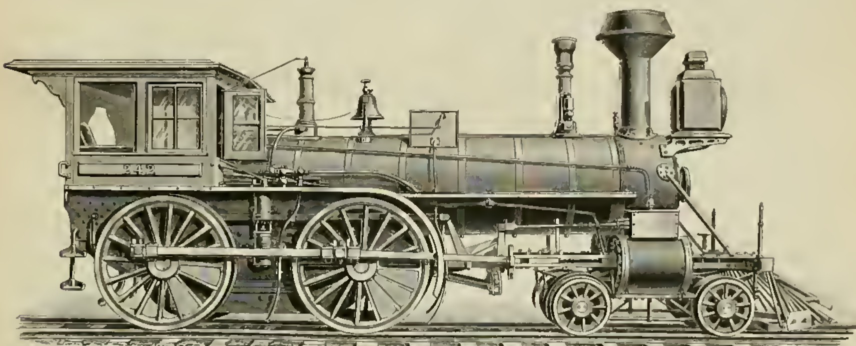
VOL. IV, NO. 3. NEW YORK, MARCH, 1891. $1.00 per Year or 10c. a copy.

The Eddy Engines on the Boston & Albany.

There has been in use on the Boston & Albany road, or the roads that now compose the B & A., for upward of forty years, a class of engines designed and built by Mr. Wilson Eddy, who was for more thirty years master mechanic at Springfield, Mass.

These locomotives were, and are, peculiar to this road and to this maker, yet they had and have peculiar merits, else they had not survived all these years, as between 80 and 100 of them are still in service.



OLD EDDY ENGINES OF THE BOSTON & ALBANY R. R.

Mr. Eddy was born in 1813, served his apprenticeship in the noted old machine shops at Lowell, Mass., where he worked on the first iron planers built in this country and the first locomotives built in New England.

The noted Major Whistler, who early identified himself with the building of the first railroads in this country, and then went to Russia, where he developed the railroad system of that empire, and died there, after many years of service, had charge of what is now the western divisions of the B. & A., and in 1840 employed Mr. Eddy as foreman of the Springfield shops.

The road used English engines and eight or ten "crabs," built at Baltimore by Winans. These crabs had upright boilers like the "grasshoppers" but had horizontal cylinders and no walking beams, or "legs." A few Lowell engines, modeled after the English engines, were also employed.

In 1849, Mr. Eddy drew the plans for his first engine and commenced to build it, but the facilities were meager, and the engine was not in steam until early in 1851, Mr. Eddy having been made master mechanic in 1850. This engine was named after the president of the road, "Addison Gilmore." She had a single pair of drivers 6 feet, 9 inches in diameter, and cylinders 15⅝x26.

This engine was so constructed that it was not easy for the fireman to get out to the chests to oil the valves, and Mr. Eddy extended pipes from the chests back to the cab and put the oil cups there—setting a pattern that has been followed from that day till this. Had Mr. Eddy taken out a patent on this little scheme it would have been worth something to him.

This engine was one of several that competed for a prize in the summer of '51, and carried off a gold medal, still preserved by Mr. Eddy, the engine having gone over a nine-mile course in 11 minutes and 29 seconds. This was the first engine built in this country with horizontal cylinders. The Gilmore had the first frame ever built with a splice ahead of the jaws, to admit of repairs without tearing the engine all to pieces; this splice was used in all of the 136 engines that Mr. Eddy made.

During the two years the Addison Gilmore was being built, Wm Mason visited the shop many times, as he was preparing to build locomotives. Mr. Mason traveled a good deal, and his first locomotives combined the good features of most every builder in the country, among other things the spliced frame, and this useful plan became known as the Mason splice, and is to this day, although Mr Mason himself never claimed it, as it was running on Eddy's engine two years before Mason turned out a locomotive.

Mr. Eddy soon commenced to build eight-wheelers like the cut, and those with smaller wheels for freight service. He resigned in 1856 and went to Russia to take charge of a locomotive shop, but came back the same year and resumed his old place.

None of his engines had a dome, all were straight boilers with escape pipes as shown, on the left side of the boiler, just ahead of the sand box, there was a manhole plate bolted on and calked, but seldom used, the dry pipe was four inches inside diameter, of copper, and perforated along the top, the throttle being a plain slide in the T pipe in front end, the rod extending through the pipe to the back boiler head; the oil cup just back of the stack was for the purpose of oiling the throttle valve. The fire-box was four inches wider than any other make, as the frames between the boxes were only ¾ of an inch thick and bolted flat against the boiler by numerous tap bolts. The expansion of this part of the frame was little if any different from the boiler, and no trouble was experienced here, but provision had to be made for the expansion of the boiler above the frame—most boilers are fast to the cylinders at the arch and slide on the frame at the fire-box end, or swing on expansion links. This boiler was fast at the fire-box end, so Mr. Eddy let it slide at the cylinder end. The cylinders and frame were bolted to a triple thick arch extended down, no saddle being used; the boiler sheet, ahead of the forward flue sheet, was fitted inside the smoke-box and riveted there. When the engine was completed the rivets were all cut out except five or six at the top, a band of thin iron was put around the joint and held by ¾ bolts in ⅞ holes, what expansion there was was accounted for here.

The most peculiar feature of these engines was their short steam ports, eight inches long for freight and ten for passenger; some large freight engines 18½x28, with a 52" boiler, had but 8" ports.

Mr. Eddy contended then, and does yet, that there is as much danger of making a port too large as there is making it too small—he believes there is a "just right" point, and thinks 8 inches for freight and 12 for passenger not far from the proper proportion. His ports were all 1¼ wide, however, and he used a fairly long travel, 5, 5½ and 6, giving a quick valve opening. Mr. Eddy never hesitated to run his engines in competition with other engines, and while others might run faster or possibly haul more cars, he never failed to transport the same load with the expenditure of less fuel.

Back in the '70's the R. I. Locomotive Works built a mogul engine, 18x26, for the B. & A., and it was tried against two 8-wheeled, 18x26 Eddy engines, one with the same wheel and the other with a six-inch larger wheel. The R. I. engine, named "Brown," had 14" ports, the others, the Virginia and Adirondack, 10" ports.

At the first trial on the Western division, between the Brown and Virginia, the Brown had valves with ⅞ in. outside lap, no inside lap. On the second trial on the Eastern division, and also the third on the Western division, the valves of the Brown were changed to ⅞ in. outside and 5-16 in. inside lap. The valves of the others had ⅞ in. lap outside, and cut out 1-16 in. lead on each end inside. The throw of valves was in both cases 5 inches.

On the first trial between the Brown and Virginia, five round trips were made between Greenbush and Pittsfield, 105 full loaded line cars were taken east, and 175 (a large number of which were empty) were taken west by each engine. The fuel consumed by the Brown was 30,850 lbs. of coal, costing $107.97. By the Virginia, 23,924 lbs., costing $83 73.

On the second trial between the Brown and Adirondack, nine round trips were made between Springfield and Boston, 224 cars, less 24 from Worcester to Boston, were taken east, and 320, less 5 from Worcester to Springfield, west by the Brown; and 223 east and 307, less 3 from Worcester to Springfield, west by the Adirondack. The fuel consumed by the Brown was 106,150 lbs., costing $371.52, by the Adirondack, 83,090 lbs., costing $290.81. The average time upon this trial was (going east), to Charlton Summit, 1 hour and 4 minutes each trip in favor of the Adirondack and from Boston to the same summit, 1 hour, 30 minutes in favor of the same engine. On the third trial between the same engines, 14 round trips were made between Greenbush and Pittsfield; 317 full loaded cars were taken east, and 387 west by the Brown; 317 cars east and 372 west by the Adirondack. The fuel consumed was 86,148 lbs. coal by the Brown, costing $301.52; and 69,676 lbs., costing $243.87, by the Adirondack.

Thus, it will be seen that in the 37 days' trial, the Mogul burnt 223,148 lbs. of coal, costing $781.01; Springfield engines, 176,690 lbs., costing $618 41. In favor of the latter, 46,458 lbs., or $162 60.

Mr. Eddy claimed that the cause of the saving in his engines was on account of the lessened load carried on the valves, less friction in the engine and the wide fire-box.

In his later engines he used one large, cast, escape pipe behind, and none in front.

The engraving shows one of his passenger engines still in service on the road. They carry the homeliest and best sand-box ever put on a locomotive, giving absolutely no trouble and requiring no repairs. The front escape pipe has a muffler on top, the rear one a safety valve.

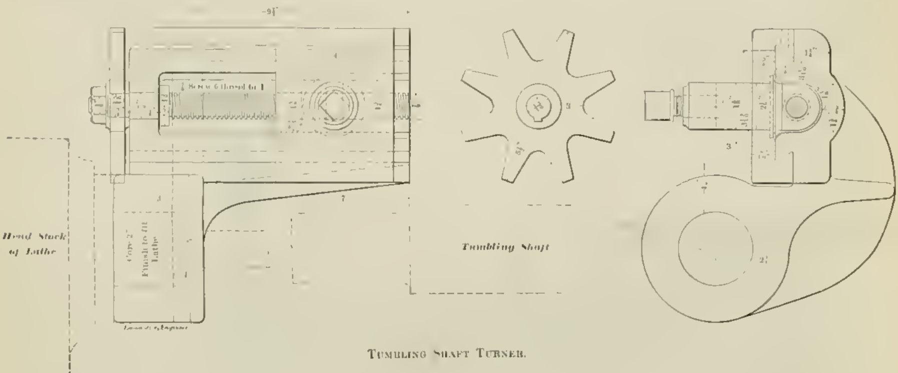
On top of the bell standards there are places to carry signal lamps, the B. & A. carrying all signal lamps there or on top of the boiler. Rigid center, side bearing trucks were used, and oil pipes were outside the jacket. Once Mr. Eddy established a plan he adhered to it, he never would change his independent cylinders for the saddle plan, yet loose cylinders was one of the troubles they had to contend with, especially as the engines got old and the arch sheets began to cut away.

This engine has air-brakes and injectors, but his engines had, before the day of injectors, eccentric pumps worked from the back axle.

While modern practice does not follow many of the peculiar and particular ideas early introduced in these engines, they were, no doubt, among the best engines in service when first built, and are to this day successful and economical machines, and their forty years of service are the very best arguments on their designer's side of the question.

Mr. Eddy retired in 1880 and was succeeded by his son, W. H. Eddy, who is still M. M. of the Springfield shops, where his father put in the best 40 years of his life.

These locomotives are now, and have been for years known among the men on the road as the "Eddy Clocks."



TUMBLING SHAFT TURNER.

Lathe Attachment for Turning Tumbling Shaft Bearings.

The engraving on this page shows a very simple little tool for turning up the bearings on tumbling shafts, or other similar work that is too large to swing in a lathe.

As will be seen, the main casting of the device is screwed on the lathe spindle in place of the face-plate, the tumbling shaft is held between the centers, the arms preventing its being turned, and the tool revolving around the work trues up the bearing.

The tool-post is on a slide operated by a screw as shown, the screw is turned by a star wheel on its end, that strikes a projecting lug held by a tap bolt on the bottom of the head-stock.

The sizes being given on the engraving render further description unnecessary, and will enable any bright mechanic to make one of the tools, if desired.

This device was gotten up at the West Chicago shops of the C. & N. W. road, and is in use in the principal shops of the system.

Engineer Robert Brown, of the New York Central, was killed in a collision caused by a misplaced switch at East Rochester, N. Y., February 4. He was one of the best-known engineers in the country, having been one of the early runners on the Rock Island, Illinois Central and U. P. He carried a handsome watch and chain presented to him by the engineers who ran with him out of Chicago. He had been on the Central for the past twenty years.

The Staff System of Running Trains in a Hole.

President Clark, of the N. Y., N. H. & H., was over to Europe last year, and there saw in operation the English plan of running trains over a short piece of single track, known as the "staff system." There is a brass "staff"—and only one—usually with a key on the end of it, and when an engineer has this staff in his possession he knows there is no one on the track, and he has the absolute right. Once over the ground the staff is left in the possession of the station agent, switch tender, or put into a box, and the next train, going in an opposite direction, can take it and go over the line. This is used on short lines, over bridges and through tunnels where the train service is light and not worth the expense of keeping operators at each end of it.

On his return to New England Mr. Clark decided to use the staff system on about seven miles of single track out of New London, while the second track was being built.

The system was introduced with a hurrah, and many of the papers told all about its advantages, even going so far as to show a picture of the staff. The plan didn't work first-rate from the start, and the dispatchers commenced to help it out with train orders—the way the trains should have been handled from the start.

But if this was done the staff part of the scheme got moldy from disuse, so orders were given to run by the staff only.

The traffic over this part of the road is considerable, and trains were not evenly divided in each direction, so a switch engine was often obliged to run over the line for the sole purpose of "toting" the precious staff.

Not long ago a train slowed up at the end of the bridge to receive the staff, and the engineer made a grab for it as he passed, but missed it, and the staff fell into the water.

The engineer, very properly, refused to proceed without the scepter of royal authority, and so the single track line was tied up while all hands fished for the staff. After some hours the key to the situation was recovered, and the train proceeded on her majestic way, and several other fellows who had trains waited long and patiently for their turn at the "brass barber pole."

All this shows that the staff system is a great success for American conditions, for no sooner was the staff recovered from the water than the train was off. Had a telegraph operator been dropped into the Thames for an hour or two he would have been useless when recovered, and a new one would have had to be sent on to take his place. Score one for the staff.

Extensive tests on several roads, notably the Santa Fe, have proven that the most successful composition for lining truck brasses with, is composed of six parts of lead to one of antimony.

The office of mechanical engineer on the Santa Fe has been abolished. Big Four ditto.

The Old-time Flyer, Lightning.

The engraving on this page is a faithful reproduction of an original lithograph, made more than forty years ago.

This style of engine—driver back of fire-box, and extra carrying wheel—have been quite extensively used in Europe, and are known by their designer's name, "Crampton."

This engine was built at Schenectady, N. Y., by the Norris Locomotive Works, then located at that place, for the Syracuse & Utica Railroad.

She had cylinders 16x22". The drivers were 84" in diameter, the carrying wheels were 48", and the front truck wheels, 42". All these wheels were solid forgings, the first of their kind ever made in America.

Her boiler was only 42" diameter at smallest ring. There were 116 2"-tubes, 10' 3" long. The fire-box was 54' long, 36" wide, and 54" deep inside. There was a three-inch water space all around the fire-box.

The frames were of the old double style, the main frame being 6" x 1¼", set edgewise. The outside frame was 4"x1½".

The center of the boiler was 64" above the rails.

The Gooch link was used, and the gear arranged to cut off at any point from one-eighth to seven-eighths of the stroke. The complete engine weighed twenty gross tons.

At the top of the driver, behind the name plate, there was located an odometer that recorded the number of revolutions of the drivers.

This engine ran before the days of rubber hose, and used the old, combined ball and slip joint on the feed-pipe connections between engine and tank. This engine had a glass water gauge—one of the first.

As will be seen, steam came direct from dome to steam chests in copper pipes, and the exhaust was conducted to the stack under the boiler.

The load on the drivers could be varied by changing the fulcrum pin between the equalizer and the frame. The extra notches are shown in the equalizer and frame through the driver.

The "Lightning" was an exceptionally well-made machine, but had too small a boiler, and was too light for much useful work. She made her first trip in December, 1849, and remained in service only about a year. Her fastest record was 16 miles and 88 feet in 13 minutes and 21 seconds, hauling eight 8 wheeled cars. Sam'l Draper, engineer. This was on February 2, 1850. She was cut up at the Schenectady Locomotive Works in 1854.

A neat little book of outline drawings of four classes of locomotives, with dimension lines for keeping data of sizes, has been issued by Coodbaugh, McMann & Pomeroy, of 45 Broadway, this city. The books are very useful to locomotive engine and shop men. They will be sent free to those who mention this paper.

Northwestern Shops at Chicago.

The writer had about an hour's spare time to put into the Chicago & Northwestern shops, at West Chicago, on a recent trip west. We got only a few snap shots.

This shop is unlike most other railroad shops, in that it has all the room needed, and to spare. The road owns 240 acres of ground where the shop stands, and the buildings are not crowded up like a ten-dollar man in an eight-dollar coat. The yards around the shops are roomy, and lots of the ground is still left for pasture. The buildings are good, and the shops all the way through are far better than the average, but it has been the policy of the management to build their own machine tools, to an extent that has filled the shops with tools unlike any others in existence, to say the least.

Many of these tools do excellent service, and fill the bill, but they must have cost double what standard tools could have been had for. Mr. William Smith, the new superintendent of motive power, is one of the kind of men who believe in getting well-known and tried tools, where he can buy the cheapest, and will probably build only such machines of their own design as are not on the market.

They were building a couple of double headed bolt cutters when we were there, that have some features of their own. They do a nice class of work with dies, their stud threads for steam-tight work resembling lathe work, and giving them no trouble whatever.

There is a large and well-equipped tool-room in this shop, and a special tool shop back of it, where all taps, dies, drills, reamers, and, in fact, all small tools, are made. This is a department seldom found in American railway shops.

This shop has built many locomotives, but the pressure of repairs is too great for that now. The road operates 800 locomotives. The first of 60 new engines are beginning to arrive now.

They make a good and a cheap engine truck here, the plan of setting up and drilling the frames and jaws being shown on another page. These trucks have a large, rigid center, but it is made in two pieces, fitted together with heavy bolts in slotted holes, so that the center bearing can be shifted sideways to keep the flanges from cutting.

The boiler shop is large, and the work seems to be done with a view to good work, regardless of the cost.

Much of the line in the Northwest goes through a country where good water is as scarce as gold, and boiler repairs are heavy. Flues average a life of from three to four months, and fire-boxes do well to hold out for three years.

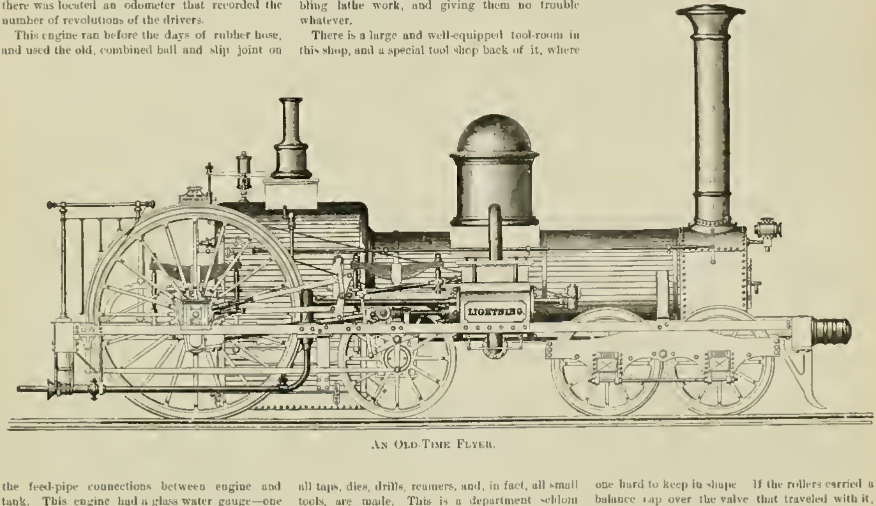
Some experiments have been made here with a Nathan lubricator that very much simplifies the cup for three feeds—one for the air pump. In the regular three-feed cup the front, or gauge glass, of the cup is used for the air-pump feed, and there are several extra inside and outside pipes. On this road they took one of the old cups, without the third feed, and tapped a hole into the side of the elbow valves on one glass, screwed in extra valves, and put a glass between them. The top valve was connected by a small copper pipe direct to the steam pipe of the air pump, the lower valve regulating the feed. This retains the handy gauge glass in the front of the cup. Mr George Royal, of the Nathan Manufacturing Company, with his usual promptness, secured this device for his firm just as soon as it popped its head up.

The blacksmith shop is a very large one, the road doing their own axle and other heavy work.

Outside the roundhouse we noticed a pressed wrought-iron boiler front. It had been taken off on account of difficulty in keeping a tight joint at the door.

One engine in the house had an extremely wide steam chest, containing a new device for reducing friction between the valve and seat. At each end of the ports there was a rack of cut teeth set. Each end of the valve had an overhanging projection, on the under side of which a corresponding rack was cut. Between these two, a toothed segment of a wheel oscillated, carrying the valve slightly clear of the seat, without steam. When working steam, the valve face just touches enough to make a joint. This engine, it is claimed, is doing good work, and handles easily, but it would seem that the plan called for too nice a job for locomotive work, and one hard to keep in shape. If the rollers carried a balance cap over the valve that traveled with it, and had its steam tight joints on the sides and ends, it would seem to us to be more promising.

All the engines coming out of the shop have the Henney variable exhaust, the invention of one of the division master mechanics. It is illustrated in another column.



AN OLD-TIME FLYER.

"A Hoodooed Hoodoo."

The lodge of Locomotive Firemen at New Haven rent their hall of the order of Elks. Recently the boys bought a "Hoodoo model," and asked the old he-Elk where they could put it. He told them to put it into the banquet room, but to get a case made for it so that it would not be injured. The carpenter employed made a box to go over it that would take up the least room, and when it was done and stained it looked just like a coffin set up on legs. A few days after it was in place, the old he-Elk sent for the secretary of the lodge and asked him what in the name of the everlasting gee-whiz they had in that casket. Said he: "We tried to have a little banquet after initiation last night, but the boys couldn't enthuse with that thing there, and the whole thing was solemn as a church, so the lodge voted that I tell you to please remove the remains or get a new hall—we don't keep a vault."

The Cushing Draw-bar Stop.

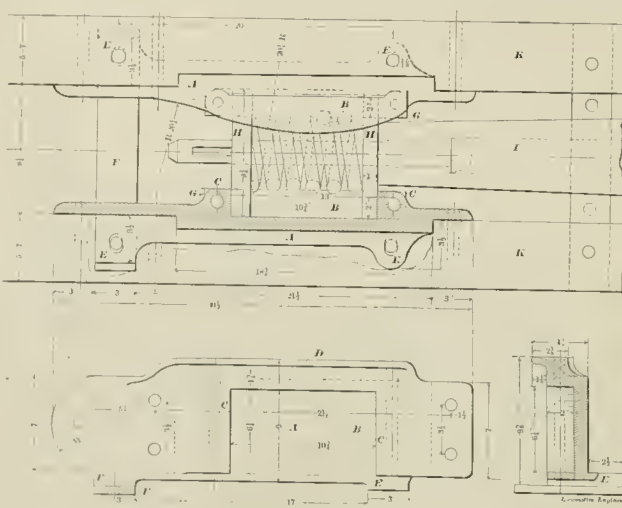
When George W. Cushing was Superintendent of M. P. of the Reading he found endless trouble with the draught rigging of freight cars, the very large locomotives used there having a tendency to develop weak spots in draught rigging. Mr. Cushing went from there to the U. P., and, finding the same trouble, set about to devise a remedy.

The great trouble seemed to be the weak construction of the frame work that transmitted the shocks from the draw-bar to the frame of the car. The draught timbers were light, and the stops being in two pieces, bolted ahead and behind the spring, had a tendency to pull their bolts through the timbers, and otherwise get themselves into bad shape.

Mr. Cushing devised a double stop, with spring pocket, having part of its side let into the timbers, and securely bolted thereto, extending along the top and bottom were heavy strengthening ribs, and the two stops were tied together by heavy wrought-iron straps, so that there should be no spreading of the timbers.

The lower side of the pocket was left open for the insertion of springs, but the back end of the bar and the spring were supported by carrying strips bolted below the stops, that prevented the loss of springs where draw-bolt was broken and head pulled out. This stop reduced the expense of car repairs on the U. P. very perceptibly, and in order to protect the road Mr. Cushing took out a patent on the device. Since he left the road there has sprung up a demand for the stop, and Mr. Cushing has been more or less busy for some months overseeing their application to a large number of freight cars built at Pullman and other shops. The stop is highly spoken of on the U. P., where a great many are in use.

Mr. Cushing intends returning to railroad work when the right opportunity offers, but is not the sort of man that sits down in the winter and wishes it were spring; you will find him busy with this stop at his office in the Rialto Building, Chicago.



CUSHING DRAW-BAR STOP.

The Wear of Driving Wheel Tire.

J. N. Barr, Supt. of Motive Power of the C., M. & St. P. road, has been making some experiments to determine the cause of uneven wear in driving wheel tire. At a recent meeting of the Western Railway Club, Mr. Barr gave the results of his test, from which we condense the following:

At first sight the most natural conclusion is that the tire varies in hardness, or resistance to abrasion, and this undoubtedly is the cause of a portion of the trouble, but from an extended series of observations, the writer is compelled to conclude that a material portion of the trouble lies outside the tire itself. This conclusion has been arrived at from the following observations:

First—The tire of several locomotives showing serious flat places have been slipped around on the center, then turned up and placed in service. The flat places in every case formed again at the same place relative to the center, but in a different place on the tire.

Second—Observations made on a large number of tires running in a sandy district showed that the flat places grouped themselves with a close approach to uniformity, occupying nearly the same position with reference to the pins and counterbalance.

The above clearly indicates that there are cases of irregularity in the wear of tire, due to the forces which are in action in operating the locomotive, and it is the purpose of this investigation to partially determine the nature, extent and influence of these forces.

Mr. Barr took a 16x24 locomotive, having 62" drivers and a weight on all four of 54,000 pounds, carrying 160 pounds of steam, 130 steam chest pressure, cutting off at 6", and determined the weight on each wheel at 40 miles per hour, for each tenth degree of the wheel. He found that for a point covering 90 degrees of the circle and laying in front of the crank-pin the tendency of the counterbalance and reciprocating parts was to overcome the adhesion and slip, thus wearing the tire.

The left-hand tire wore the most, and all the tires wore more or less unevenly.

A change of steam pressure, speed, or cut-off changes the wear and its position on the wheel. Many tables were compiled and details given, but these are the important points. The paper concludes as follows:

1. Flat places on driving wheel tires are not entirely due to lack of uniformity in the wearing quality of the same.

2. The flat places have a tendency to group themselves where the coefficient of slip is greatest.

3. They vary in depth with the pressure on the rail, and when the pressure does not exceed 11,000 lbs the imperceptible slip produces but little abrasion.

4. Imperceptible slip does not appear at random on any part of the wheel, but in special localities, as fixed by the maximum values of the coefficient of slip.

5. The counterbalance should be as light as possible compared with the reciprocating parts, consistent with smooth riding.

6. The weight of the reciprocating parts should be as light as possible.

The 19x26 "hogs" on the N. Y. Central are in great disfavor with the men, they pull lots of cars, but are unwieldy in getting out of the way. Big engines are money savers if the road is not so level that they can pull fifty or more cars; trains of that length are heavier than links and pins can stand, and break-in-twos cost money, and cause endless delays.

A Big Jump.

Early in February, a 20x26 consolidation engine on the Boston & Albany got away from her crew at the top of a long hill and started off down grade with the throttle open. The telegraph was put to work and a switch was opened some ten miles away, that would send the runaway up a high coal chute, and, it was hoped, stop her without damage. She sailed into town at a moderate speed, mounted the coal chute gracefully, and jumped off the end, some eighteen feet to the ground. The bridge jumper lit on her feet, so to speak, and sank well into the soft ground, but the tank, not to be outdone in agility, turned a somersault, alighting on its back, and in so doing smashed the cab. Nothing of importance was damaged, although broken frames and bent axles were expected. The engineer, who had been knocked off by the engine's being struck by a train being switched behind her, followed on foot to the next station and there got a hand-car, and together with the fireman arrived in time to pull the fire; the injector being on at the time of the accident prevented any trouble from low water. The rumor among the men that the company had decided to name the engine "Steve Brodie" has been denied.

When Angus Sinclair was a boy in the telegraph office of the old home road in Scotland, he had the "engine fever," and used to spend his spare time around the engine sheds, where he soon struck up an acquaintance with the firemen, who used to swell him up with pride by allowing him to do sundry chores for them on the way to the trains. He learned rapidly, and one evening was elated more than usual when one of his stoker friends got down to oil and told him to "fill up the fire"—a common expression then. Angus had not written his pamphlet on combustion at that time, and translating the stoker's instructions literally, he "filled up the fire," and the fire-box as well, while his friend was busy elsewhere, and the engine started out with a mail train—losing two hours. The stoker has it in for Angus yet.

The rapid introduction of pressed steel parts of cars and locomotives has given the roads a great many pieces of half the weight and double the strength of castings. Every pound of weight gained in car construction is a source of economy as long as the car is in service, but we are inclined to doubt the economy of using pressed steel for locomotive work. In the first place there is not the objection to weight that there is in cars, and the cost for doing repairs are greater. Bent wrought-iron or steel front doors, etc., cost much time and patience to straighten out, and serious crimps can only be repaired by a forming press—which no road could afford to keep.

It would be a hard matter to find a substitute for cast-iron that would facilitate and cheapen locomotive repairs, especially those parts liable to breakage in every-day service.

You can learn to estimate the weight of castings by getting some idea of the cubic inches contained. Four cubic inches will average a pound.

The Coupler War.

The New England Railroad Club, with J. N Lauder, of the Old Colony, in the lead, have stood bravely up in meeting and said their little say about the M. C. B type of coupler. Mr Lauder lays a good deal of the ills he suffers to the railroad papers. This is hardly right, as the M. C. B. coupler was given a send-off by the Car Builders' Association, pushed, especially by the P B R, that had adopted the Janney before it became the standard. The papers bowed low before the M. C. B. type—for advertising only—and defend it against the world

It is altogether likely that if there were no link and pin couplers to mix in, the hooks would do far better than they do now, but there is no denying the fact that they are a great expense and an awful nuisance. If every master mechanic and master car builder in this country were to stand up and tell just what he honestly thinks of the M. C. B. coupler, we venture to say that it would make the hook coupler men sick—exceedingly sick

We admire Mr Lauder and the New England club, they believe they are right and are not afraid to say so—that would be admirable even were they wrong—and it is quite likely they are not.

Long Island Notes.

Cooke's are building some new passenger engines for the Long Island. This road does an enormous passenger business in summer, and a comparatively light one in winter, and these engines are designed to burn soft coal in winter and hard in summer, they have long fire-boxes on top of the frame, and when rigged to burn soft coal about three feet of the front of the grates is bricked over. They are 8-wheelers, 17x24, weighing 90,000 pounds, with Master Mechanic Thompson's cab set over the forward driver, and an iron summer kitchen on behind it. The crank-pins are hollow, and have small holes drilled from the face of the bearings through to the large hole in the center, this hole is about an inch in diameter, and does not go clear through the pin; it is filled with cold tallow, and a brass plug screwed into the end. When the pin gets warm the tallow melts, and gets in its work A great deal of trouble is experienced here from sand.

The new shops at Jamaica Plain are very neat and substantial, and fitted with overhead cranes, some new tools and a great many old ones.

This road still uses double vacuum brakes, but will in all probability soon commence to put on air. If they had not been shut out from exchange of cars with other roads, air would have been a necessity long ago. The road runs an awful lot of old rolling stock—the majority of passenger cars remember all about the war

In the car shop, getting "slicked up," was Austin Corbin's new palace on wheels, known as the "Oriental," equipped with air, vacuum, steam heat, hot and cold water, bath room, kitchen, dining room, wine cellar, and bridal chamber It is one of the finest cars ever built, but Mr Corbin can afford these little luxuries—the patrons of his road cannot. If we ever get a private car like this we'll name it the "Accidental"

The Long Island road are taking out some copper fire-boxes that have been in service for six years, this is just the life of steel boxes there. Copper costs more to begin with, but at the end is worth considerable as old copper, while steel is practically worthless.

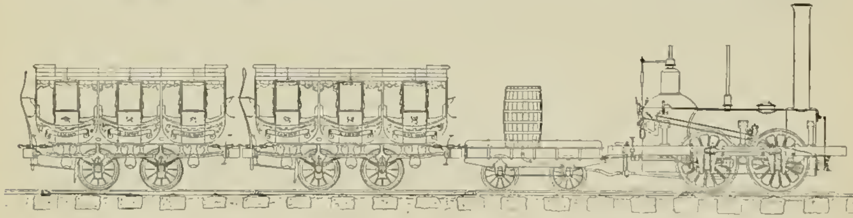
The First Railroad Train in the State of New Jersey.

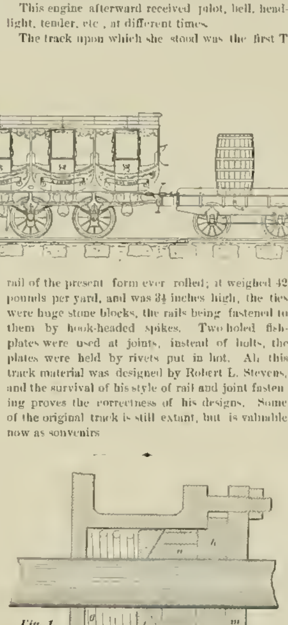
The outline sketch below, from an old daguerreotype, shows the engine and train of the Camden & Amboy road at Bordentown, N J, as it was inspected by the legislature of the little State, on the 12th day of November, 1831. The engine was the famous "John Bull," just over from England, and now in the National Museum at Washington This engine was run under steam at the Railway Exhibition in Chicago, in 1883

The "John Bull" was on this, her bridal morn, under the charge of Mr Isaac Dripps, now a resident of Philadelphia. The tender shown was improvised from a push car and a whisky cask, the hose having been made of leather by the village shoemaker

This engine afterward received pilot, bell, headlight, tender, etc, at different times.

The track upon which she stood was the first T rail of the present form ever rolled; it weighed 42 pounds per yard, and was 3½ inches high, the ties were huge stone blocks, the rails being fastened to them by hook-headed spikes. Two holed fish-plates were used at joints, instead of bolts, the plates were held by rivets put in hot. All this track material was designed by Robert L. Stevens, and the survival of his style of rail and joint fastening proves the correctness of his designs. Some of the original track is still extant, but is valuable now as souvenirs





Lewis & Whaley's Metallic Packing.

The packing illustrated herewith has been in use on engine 20, New York & New England Railroad, for the past ten months, making 30,000 miles without trouble, it is also in use on other engines on the same road. Fig. 1 shows the general arrangement of the packing. Fig. 2 is an outer end view of the packing rings *d*, Fig 3 being a cross section of the same on the line *X*; Figs. 4 and 5 show the coned brass washer *f*; Figs. 6 and 7 show the brass gland *h*, against which the packing abuts, and makes a steam tight joint, as at *a* in Fig 1.

A spiral spring keeps the packing against the gland The packing rings are held together by a flat spring *e*, Fig 2, this gives a uniform tension to the rings. The packing is made smaller than the box, so as to admit of vibration of the rod. It is the invention of E. F. Lewis and F T. Whaley, whose addresses are Norwich, Conn.

"Way 'long about '56," said the old-timer, taking a chew of fine-cut, "the Erie were about the best road in America, and though we weren't getting but sixty dollars a month, the engineers were mighty independent and uppish like. Once when old man Minot was general superintendent, there was a plug-puller there of the name of 'Yankee Dan.' Dan were runnin' one of the old inside Hinckley's with a hook motion; on these engines the two eccentrics on a side were cast together, and when one slipped they both did. One day Dan came into Susquehanna with one side slipped just enough to make her sound like a peg-legged soldier walkin' on a plank road The president was standin' on the platform with some of the stockholders, and when the train stopped and Dan got off to walk into the eatin' house the old man sais, 'Ain't your valves out a little, Daniel?' 'Nope,' sais Dan without stoppin', 'they was both in the chests when we left Port Jervis.' He'd be hung for that now"

After long tests in actual service, the Illinois Central have decided to return to the use of case-hardened iron for crank-pins, and use iron in place of steel for axles.

Big Work by a Little Engine.

The Benedict & Burnham Manufacturing Co., of Waterbury, Conn., have quite an extensive yard about their factory, and a little H K. Porter & Co. locomotive that is the especial pride of Chief Engineer Crane Hearing that Mr Crane had indicated the engine lately, we wrote him about it, receiving the following answer

Replying to your favor of the 7th, the locomotive mentioned has 9x14 cylinders; is a tank locomotive with four drivers 30" diameter, and with the tank two thirds full of water, weighs 11 tons.

It is used for shifting purposes in our yard, and as our yard would not permit of the necessary speed to take the diagrams, I took it outside where there is a short track, and as the stiffest spring I had was only 40, I was limited to about 80 pounds pressure. To get the proper load I put on a brake until the engine had a sufficient amount.

We have one grade 184 feet on a curve of 100 feet radius. It will start and haul about 40 tons on this grade, but in the ordinary work about the yard will handle from 100 to 200 tons very nicely. It has hauled over 400 tons on a fairly level track with slight curvature. Usual steam pressure, 125 to 130 pounds.

With a flat car rigged up for an excursion, and weighing altogether about 10 tons, it made 6 miles in 10 minutes. Average grade slightly ascending

It rides very smoothly up to about 25 miles per hour, and fairly well at 35, but beyond that it jumps so badly that another pair of wheels would be necessary. Of course, it was not intended for any such speed, as it was simply built for a shifting engine

You notice that the lead is less as the lever is hooked up, which is contrary to the generally accepted idea

The builders, H K. Porter & Co., say that this is on account of their being obliged to put the fire-box over the driving axle on this size, and the eccentrics on the other axle, in such a way that it produces this effect.

As excessive lead and compression make a hard riding engine, it is possible that this feature of the valve motion makes this engine ride so easy, with the drivers making over 300 revolutions per minute. The steam distribution is such as shown by the cards that it is doing about all that is possible.

Waterbury, Conn. W. E. CRANE.

[The cards are reduced just one-half. The lead could be made to increase instead of decrease, if the links were so connected to the eccentrics on forward axle that the hooking up of lever would move the straps on the eccentrics in the opposite way from which the eccentric ran.]

Correspondence

Air-pump Valve Stops.

Editor The Locomotive Engineer.

"A Reader" asks how we get the length of main valve stop, without taking off the steam cylinder, as they run in length from $\frac{5}{8}$" to $1\frac{1}{4}$". In reply I will say that if they use the Westinghouse 6" or 8" air-pump in Wilmington, the main valve stops don't vary $\frac{1}{16}$" in length—at least I have never found one to vary that much, and I have been in the business over ten years. I have a lot of stops turned up with small end that goes in casting about $\frac{5}{8}$ long, and the end that the main valve rests on, about $\frac{13}{16}$" long and $\frac{3}{8}$" diameter. I find they all "go." W. F. RELYEA

Syracuse, N. Y.

Big Passenger Engines.

Editor The Locomotive Engineer:

The B. & O. has recently put in service three very large passenger locomotives; they are 8-wheelers, 21"x24" cylinders, 78" wheel, with a big boiler and long fire-box. They were built for the fast runs between Washington and Philadelphia, they are not yet fully "suppled up;" yet one of them is credited with having run a mile in forty-six seconds, with four cars. In a description of the Mt. Clare shops of this company, which appeared in a recent number of your valuable paper, this road is "showed up" in anything but bright colors, and while I acknowledge the corn, I think that we might have been allowed credit for the few little improvements that have been recently introduced. It is true that we have been somewhat behind the age, but the present management shows a disposition to get there, and I hope that we will eventually come out all right. The compound is back on passenger, and doing fairly well, but no better than the simple engines.

Baltimore, Md. ROBERT H. ROGERS.

For Air-pump Doctors.

Editor The Locomotive Engineer:

I said last month I would give the "boys" a tough one in the next paper. So here it is, and in a few words: I had a pump that would blow very bad on the upward stroke only. The rings in main piston, reversing piston and main steam valve were all good as new, and there was nothing about the pump that was loose or broken. Now what made that pump blow? I put on a new top head, and that stopped the blow. So you see it was all in the head, but where? W. F. RELYEA.

Syracuse, N. Y.

Grief on the Reading.

Editor The Locomotive Engineer:

I saw in a recent number reference made to the explosion of an engine belonging to this company, at Philadelphia.

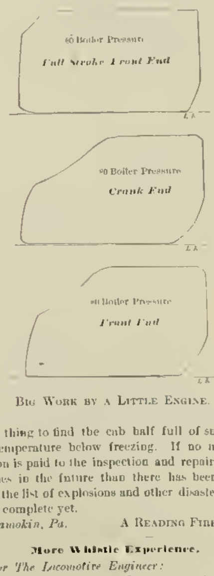
I am a fireman on one of their dirt burners, and simply want to say that it is a wonder that more of them don't go up, judging from the condition the engines are run in.

Take, for instance, Shamokin. When they want an engine to assist any of the through trains from Sunbury or Snydertown to Locust Summit, some 30 miles, the caller is sent for the engineer and fireman. When they arrive their first job is to find out what engine they get. Generally, the men have to wait for fires to be cleaned or for some engine that has been sent out of the yard on account of low steam. At last the crew get an engine of some sort—and we have many breeds—and the cry is: "Get out! get out of here, or I will mark you back on the list."

The engineer yells at the fireman to hurry, and asks if the flagman is ready—but there is no flagman. The scraper is lost—but no one dare stop for one. There is no headlight chimney, and when you run to the storehouse to draw one you are asked how you broke the other, and told that there must be a great deal of carelessness. In the cab there is a cloud of steam, because the injector valves need packing; the gauge cocks are blowing and the blower sizzing in the cab and the front end of pipe stopped up by a chunk of dirt.

All of these annoying matters must be cured or endured as best you can on the road. We hear nothing from start to stop but "Hurry up, hurry up!" Nothing is cared for, the only thing is to get over the road somehow. If locomotives are cared for on this plan, what can you expect? Our engines here are considered well fixed for the winter, but you can see cabs without glass, half of them closed up by sheet-iron or old coats. It is no unusual thing to find the cab half full of snow and the temperature below freezing. If no more attention is paid to the inspection and repairs of our engines in the future than there has been in the past, the list of explosions and other disasters is far from complete yet.

Shamokin, Pa. A READING FIREMAN.



BIG WORK BY A LITTLE ENGINE.

More Whistle Experience.

Editor The Locomotive Engineer:

J. A. N.'s inquiry in January number about whistle extinguishing lantern, reminds me of a similar case in the long ago.

For some cause the block was taken from the whistle, and the sound changed from a shrill to a course one. The first night after the change, the engineer had a time with the gauge lamp—could not blow the whistle without darkening the cab. The stopping of surplus vent on top of cab was resorted to, but to no purpose. And yet, by opening and closing the valve rapidly—keeping it open as long as desirable—that whistle could be sounded as many times during the night as necessary, and never affect the light. Does the vacuum theory hold good in the above instance? Give us more light.

Greenville, S. C. "SWAMP RABBIT."

[The writer has run locomotives that would lower and finally extinguish lights in their cabs by long use of the whistle, and had never heard of any other theory than that of the induced currents taking away from the lamp some of the necessary oxygen. This theory would seem to be at fault in this case and the one cited last month. Still we see no other cause that the phenomenon can be charged to; even should it be proven that it is the vibration of the air in a certain manner, that would not prove that the vibration itself did not lessen the supply of oxygen. Who knows something about this?]

The Reason it is Hard to Get Better Engineers.

Editor The Locomotive Engineer:

It has long been my intention to write a few lines for your spicy paper, on the subject of employing firemen and engineers. Probably I am a crank on this subject, but I maintain that railroad companies are alone responsible for the incompetent crop of engineers now growing up, and the number of incompetents has reached such proportions, that only time and patience will effect a reform. Now I am not writing particularly of men in this latitude, but we have our proportion of the class referred to, as few observing men will deny. The cause lies far back, and can be traced to carelessness of those having power to employ men in their departments. Time was, not far back, when any man was thought good enough to throw coal into an engine. Generally, his physical build had a great deal to do in procuring an applicant a position, in preference to a smaller man, physically, but probably larger, intellectually.

The great mistake has been in not recognizing the fireman as the future engineer, and in not expecting every fireman and engineer to pass an examination in reading, writing and arithmetic, the standard to be set by superintendent of machinery. Up to five or ten years ago, the man that could keep her howling was considered an A1 man. Now, this is no longer a practical test of an intelligent fireman, and it has also been demonstrated that the careless fireman is the indifferent engineer. After this is discovered, the first thought amongst officials is to gradually weed out the incompetents, but they run against a snag in the brotherhoods the first move they make; for after a man fires six months or a year [in the firemen's, and the same in the engineer's], he is eligible to membership in these organizations, and he veils his incompetency behind a big B, and, generally, the poorer the man, the bigger the B; the master mechanic discovers this after he concludes to discharge a man. He finds his ideas differ from those of the committee that waits on him, as to what a competent man is, and he concludes not to discharge the man; or if he does, he courts trouble, and possibly a strike; so it has come to that pass that a man may be known to be useless, and a detriment to a company, and still continue in the employ of said company, and a master mechanic or superintendent of machinery will generally think twice before ordering a man discharged. A reform can only be brought about in this matter by officers exercising more care as to the class of men employed, giving preference to the best and brightest, and by putting a premium on brains, and by organizations refusing to admit everything that makes application for admission, without any test as to intelligent service rendered in their department. COMMON SENSE.

Jamestown, N. D.

Throwing Water with Light Throttle.

Editor The Locomotive Engineer:

I would like to ask your opinion about an engine that works water when working light throttle, but does not when she is working hard. Engine has large wagon top, and carries water good, but as soon as I work her easy she will spit considerable. I find no indication of dry pipe leaking; besides, we have some others that do the same thing, and in a recent conversation with the traveling engineer of two southern roads, I have been informed that a great deal of trouble exists on their roads from this source, and mostly from engines with single nozzles.

If you will be kind enough to give us your opinion about this, you will oblige several readers of the paper here. JOSEPH NELSIS, Engineer

Springfield, Ill.

[It is very likely that your trouble comes from condensation, and the collection of water in the exhaust passage. When your engine is working hard, the force of the blast carries all of the water out of the nozzle with the exhaust steam at each pulsation. When working a very light throttle, and cutting off close, what water there is in the exhaust steam collects in the lowest bend in the exhaust passage, until the area of opening is so small that the steam commences to pick up the water and carry it out with it. You will probably cure the disease by drilling a quarter inch or three-eighths hole into the bottom of exhaust passage in each saddle. These holes will prevent the collection of water in the passages at any time, and do much to keep the engine clean and comfortable, and the leakage of steam from them will hardly be perceptible.]

Running with One Eccentric Rod Down.

Editor The Locomotive Engineer:

I am a regular reader and would like a decision through the columns of your valuable paper in regard to a breakdown. In making my trip with a passenger train on the D. S. S. & A. Ry., east from Duluth, a set-screw worked loose and dropped through eccentric into collar of strap, and broke eccentric straps and eccentric rod in two places—left back-up eccentric—leaving me with both go-ahead eccentrics all right. Now I had serious doubts whether I could handle my train with one side or not, taking into consideration the condition of the road, having one car more than the usual train, being seventy miles from the end of my run, and twenty miles of the seventy up hill, and the road heavy with snow. Under the circumstances I immediately concluded to work both sides of my engine; I therefore put reverse lever in extreme forward notch, and blocked link down solid on link block and secured block from falling out if it did work loose, by tying bell cord several times around the link, and started working my engine in full motion. I brought my train in all right, and only losing about forty five minutes over the regular schedule time in the seventy-mile run. Having had some argument with the master mechanic, and more with the boys, I concluded to ask your advice under same circumstances. L. L. HOOD.

Duluth, Minn.

[Not knowing the exact conditions, it is difficult to tell what was best to do or not to do. The danger in a case like this is from the lower end of the link swinging far enough to strike something; for instance, back of truck frame; the success of your experiment would seem to prove your good judgment in this case, you guarded against excessive slip and a "cramp" by the use of the block. We think under the circumstances you did right.]

Putting Water into Red-hot Boilers.

Editor The Locomotive Engineer:

In Bro. Sinclair's "Testing Red-hot Boilers," page 29, *National Car and Locomotive Builder*, for February, he says: "There is a prevalent belief among people who ought to be better informed, that should a steam boiler get hot through shortness of water, and feed water be suddenly injected upon the hot plates, an explosion is almost certain to follow." He then cites several experiments where steam was generated in different boilers, boilers then blown out without drawing fire, and allowed to stand a sufficient length of time to heat crown sheet red-hot; cold water was then forced into it with a steam fire engine. Result: No terrific explosion—nothing except a gradual cooling of plates, "only this, and nothing more." Query: Would the result have been different had the experiment been tried on a consolidation engine hauling twenty loads up a 100-foot grade, with 180 pounds boiler pressure, crown sheet exposed until it became red-hot, and a sudden injecting of cold water upon it? I don't think Bro. Sinclair would have nerve enough to "stand within five feet of it, with his hand on it most of the time," but would prefer to view it from a safe distance through a field glass.

One of the first lessons taught me when I began firing, was the necessity of keeping the crown sheet covered, of course that was some years ago, but the rule must still be observed. I would not advise any of the readers of THE LOCOMOTIVE ENGINEER to experiment any along this line, for fear they might not be able to "collect their scattered thoughts" and tell the result. Don't you think so?

Albany, N. Y. SID.

[The dropping of the crown sheet is to be expected under these conditions, but does not occur once in ten times. Water always tends to cool and stiffen the sheet; heat softens it, and when there is pressure above, a hot sheet is easily forced off the stay bolts; the very common belief that sudden contraction brings the crown down is wrong—it is heat and pressure; the sudden injection of cold water might tend to suddenly increase the pressure and thus aid the rupture.]

Some Driver Brakes and the Men Who use 'Em.

Editor The Locomotive Engineer:

I read your item on the crippled driver brakes with some amusement.

The main trouble with steam driver brakes is that most of them have no way of getting off except by the weight of the toggle, so in order to admit of their application and release during the same week the boys do not pack the piston. This allows a mist of steam to waft heavenward just as you are making a flying switch or a bad coupling, and your ears must tell you whether the switchman has got the target over, or the gafter got safely out from between the cars. In cold weather you will find many plug-pullers, like me, using the bar in preference to taking chances. The American Co. have recently put a sort of bonnet on their brake cylinder, and use a spring to hurry the release. This keeps the company doctor from lots of practice.

Engineers hate to see steam escape from any valve except the pop.

When the first driver brakes were put on the Cumberland & Pennsylvania, they tried two kinds—the vacuum and the steam. The 19 was in for repairs and got the steam brake. The vacuum was put on the 18, nights. The first morning the holes were drilled in cab bracket, a few bolts in place and the hangers up. The second morning the vacuum pan, or "kettle," as the boys called it, was up, the diaphragm shoved into it, and the connecting rod banging loose in the hanger. Some of the boys "'lowed" that it would be connected to the crosshead and vacuum pumped up. The third morning it was complete, but the engineer did not know how to use it until he was told by the M. M., and then hardly understood it.

The other engineer was made of different stuff and wrote the steam brake company for instructions, got a book and studied up, and when his engine came out he was the only man that knew how to handle it right. The boys at once named the steam brake the "jim crank" or the "wind jammer," while the vacuum is known only as the "old suck."

Mt. Savage, Md. HANK.

Using Compressed Air for Everything.

Editor The Locomotive Engineer.

I met my friend "Doc" the other day, while the passenger train he was drawing was stopping at the eating house for dinner, and he was mad all over because he had to run his air-pump so fast to keep up the pressure. I tried to console him by saying that lots of pumps had to run faster than his did, and that some engineers let their pumps run full speed from choice. "That don't make any difference with this pump," says he, "it is in first-class order, and there is plenty of air going into the reservoir, but they use it for everything under the sun after it gets past there. In the first place, it is piped up into the water tanks in the sleepers, and pumps the water into the wash basins by forcing it out of the tank. Some of them don't get the pipes just right, and the consequence is that the water gets back down into the train pipe, then the first cold night the air pipe is froze up solid, so we can't use the brake past that car. I have been caught that way once, so it is no fancy statement. Then they run the air pipe up into the reservoir of the gasoline lamps, and use it there to light up the coaches. There ain't much used for that, of course, but every little helps to make it harder to keep up the supply. One of our cars has got a patent step that lets down close to a station platform, and when you get a signal to go, how do they raise it up again? Why, with air pressure of course. Look at the private car back there, it has got some sort of a trap under it to shut off the steam from the heating apparatus in case of a wreck, but for the life of me I can't see what they want to shut off the steam for. That uses air, too. Then they have a reservoir of water in the corner of the car, with a pipe leading into the Baker heater, and some kind of a dingus in it to let the water into the fire in case of a smash-up. That's all right, for I don't care where the air goes after a smash up takes place, if they can use it to put out the fires, good enough.

"I hear a fellow has got up a machine for calling the stations, which works a sign in each car to show the name of the next station. What works it? The air, to be sure. I suppose we will have one on this train before long, and if they make one to ventilate the cars, and carry out grips for good-looking girls, the brakemen won't have a soft time. Oh! no! The bell ringer on the engine works with air, too, and that's pretty fine. I like it lots better than steam—it's cleaner, easier to regulate the ringer, and if the packing leaks a little around the piston rod, it don't hide your view ahead or cover your window with water, like a steam ringer does. Ike, the traveling engineer, is going to have a sand pipe put on this engine with an air attachment in it for running a nice, fine stream of sand on the rail whenever you want it; the M. M. of the Fitchburg Railroad got it up. I saw one working the other day when I was down at Fitchburg; it is fine, you can have just enough run on the rail to keep you from slipping.

"I wouldn't kick so hard about this air business if it was not for one thing—when you set your brake light and easy, the leaks under the cars for all of these fixings take some more air out of the train pipe, and sets it too tight, then it has to be let off before we get to the stopping place, and that makes me hot. I don't calculate to set the brake but once for any ordinary stop, but a leak in the train anywheres beats me. Some fellows set it and let it off again two or three times in making a stop, and, of course, they run by most every time. I have no patience with that kind of business. The air signal is all right; I thought it was a nuisance at first, but on a long train it beats a bell cord all hollow. If it is put on all right, and all the joints tight, it won't bother you any, but some of them have to whistle on their own hook pretty often—that makes a fellow think something is wrong; I don't know what makes them do it.

"Have you seen the electric headlight yet? One of our boys told me that you could not see colored lights very plain with it, is that so? I don't believe it, for it don't seem reasonable. The next time you are near one, find out for me, will you? My idea of the electric headlight is to use an incandescent globe instead of an arc light. I don't see why an incandescent lamp set in our reflector where the burner comes won't work as well as a kerosene lamp, and give ten times the light. They say the little loop in the lamp won't stand the shaking on an engine. They are used on street cars which ride ten times as hard as the front end of an engine. You can carry a storage battery on the engine that will run one of these lamps for three or four days. One of our sleepers used to be lit up that way, and they had twelve in it going at once."

The conductor came along just then, gave "Doc" his tissues, and off he went, leaving me to meditate on what he said. It is a fact that some inventors in the car department seem to think that compressed air is like salvation—free, and the more you can use the better you are, and that any new labor-saving contrivance for a passenger coach is not perfect till it is made to go with air. If all the pipe fittings are made in the best style, the check valves between the train pipe and these patent fixtures tight, and sure to always drop in their seats, it is not much matter if a little air is used, when these extra pipes are connected to the auxiliary reservoir it must operate to gradually release the brake if there is a leak. Leaks of all kinds cost money, and make bad work, whether in air pipes or fire-boxes. The electric light costs so much for original plant and running repairs when in service, that companies don't think but once when the cost is compared with the kerosene burner they now use, which costs so little.

Port Huron, Mich. C. B. CONGER.

About the Size of Injectors.

Editor The Locomotive Engineer:

In answer to a question about the size of injectors in a recent issue, you made a mistake in saying that the size was determined by the size of "combining" tube. The size is always determined by the "delivery" tube, the smallest in the instrument. But I write to put your readers right about this supposed "standard" for sizes.

The old Giffard instruments were numbered as you state, by the number of millimeters the delivery tube was in diameter. The Messrs. Sellers followed this plan in their instrument of '76, and stuck to it reasonably close. Conditions were changing all the time, and when it was found that an injector was slightly weak in its water supply an easy remedy was found in reaming out the tubes.

The Sellers self-adjusting instrument will throw more gallons of water per hour under varying steam pressures than can any instrument without the self-adjusting feature, providing the delivery tube is the same size in both instruments.

The tests made of the '76 or self-adjusting injector some years ago rather established a standard of capacity in gallons per hour, and the other makers enlarged the delivery tubes of their instruments to bring the capacity up. This increase of size varied, being controlled more or less by differences of construction or design.

The Hancock inspirator people made a departure from the usual practice and numbered their instrument by the number of 100ths of an inch in the diameter of the delivery tube, and their locomotive sizes range from 10 to 50.

The Rue Co. used to prefix one (1) to the number of their Little Giant, to distinguish the locomotive pattern from the stationary; thus a number six became 16, and there are still in use many of their older instruments so numbered; they soon dropped the extra number, however. The new, re-starting Sellers will not throw as much water as the old with the same sized tube, and so they had to be enlarged to take the place of the old ones. So you will see that the original plan of measuring the size of an injector has been virtually abandoned for the more practical one of determining the number by the actual capacity in gallons—the size of the delivery tube always governing this capacity.

There should be a standard established for locomotive injectors that would simply call for a certain number of gallons per hour at some given pressure—say 140—then a No. 7 of any make would throw a given amount of water, and railroad master mechanics, engineers, etc., would not be bothered by the differences in range and capacity as now, although there is not as much difference as one would expect where a matter of this kind has been allowed to settle itself. Trusting that this will put you and a great many interested parties right in the matter, I am an

INJECTOR MAKER.

About Increasing Lead.

Editor The Locomotive Engineer:

I notice an answer in your issue of February, 1891, No. 12, J. B. Horner, Shamokin, Pa., in which you say *Yes*, in answer to Question 1, which is: "Does the hooking back of the reverse lever increase the lead on the valves of a locomotive?" Do I understand you to mean that when the reverse lever is brought nearer the center of the quadrant that the lead is increased? That is the way I understand your answer and I think you are wrong. Please answer in your March number and oblige

Shamokin, Pa. JOHN MCELIECE.

[The shifting link always changes the lead when the point of cut-off is changed. It can be put up in such a way as to decrease the lead, but probably not one locomotive in five hundred is so hung. Engines with a stationary link and shifting block maintain a constant lead—the shifting never does.]

Two Useful Kinks from the Chicago & Northwestern Shops.

Editor The Locomotive Engineer:

I send you two blue prints that may be of interest. One shows a frame that our engine trucks are built on, which requires little or no explanation.

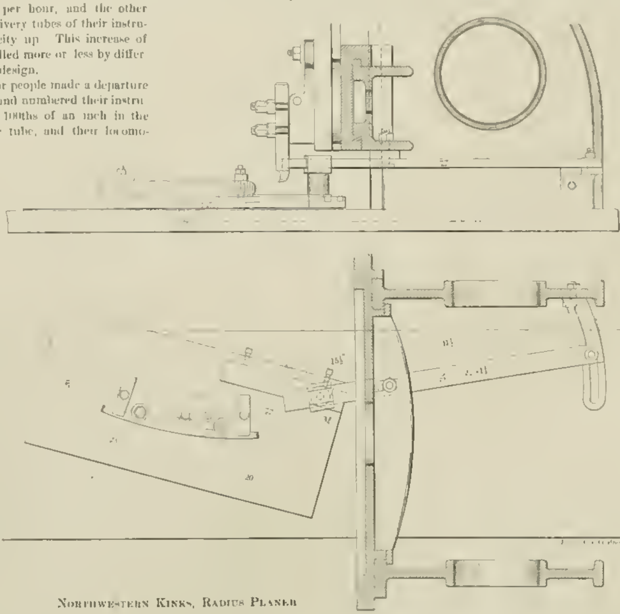
Under a large bracket-drill built on a column of the shop, there is a track on which our big jig travels. There are four solid upright castings that fit between the jaws of the frame where the box goes. We place the jaws against the casting and adjust the set-screws from behind, pinching the jaw tight up against it, afterwards we put the frame on, and a clamp, shown at A in elevation (on page 49), swung on a loose bolt through the casting, binds the jaws and frame all together. We have two different sized trucks that we build: one has a large box, and the other a small one; for the small box, the jaws come up against the casting, and for the larger box we have liners that we put one on each side of the casting. That makes the jaws the size we require.

After the top plate is put on the frames and one side drilled and reamed and the bolts put in, we have the center clamped down with two clamps on either frame. We then take an eye-bolt with a cotter through it, drop it down over the center pin, and overhead we have a crane that hoists the whole thing up and turns it around—the drill press being of a very ordinary type, and built to clamp so as to render it stationary.

We place one end of the truck under the drill press, and after one hole is drilled the truck is simply pushed along on small wheels running on a rail bed that is laid to accommodate them, so that the hole comes directly under the press, and all that is then necessary is to feed it down.

With regard to the blue print of radius planer, I presume you will readily understand this with little explanation. We turn up a center, as shown on blue print, about six inches in diameter, this is let half way through the plate for fastening the work on; the plate is merely placed on top of this round center, without anything to hold the plate in position, excepting simply its own weight. The bar, of course, swings the plate with the travel of the table. The desired radius is obtained by moving the bar back from the table, either in or out. When one becomes accustomed to it, it can be set very quickly. The man that works ours has marked the back end, so that by placing the bar at a certain mark a certain radius is secured. Of course, a good plan is always to run the radius over before starting the cut. It is a very convenient tool for various kinds of work in a repair shop.

Chicago, Ill. MECHANIC.



NORTHWESTERN KINKS, RADIUS PLANER.

Our Re-cousined Pooh Bah.

Editor The Locomotive Engineer:

I've been waiting over three years now for one of our men to die so as to write you about him, but he don't seem to have any idea of dying afore I do, so I'm going to get out his obituary in advance.

I used to think he was a character, and studied him, then I came to the conclusion that he had no character and studied him more; he's an "amoosin' old cuss," but, bless you, my boy, what a row he kicks up everywhere he goes.

He was raised a pet on the same road our General Manager came from, has some sort of pull, and wears a title something like service inspector, though he seems to be something like an extra tail, hitched on to the motive power department.

Our G. M. is a nice old fellow, but he wants to have things so that no officer under him can make a move without his approval, and every move must add a star to his crown; he "brooks no rival near the throne," therefore The Tail is a valuable appendage.

The Tail has five cousins, two sons, four brother-in-laws and a nephew, in good, easy jobs on the road. One daughter pounds a type-writer and chews gum in the old man's office, and another has married the claim agent.

For all this, you never did and can't to-day mention a good berth on the road but what The Tail will tell you of a cousin or a something-or-other of his that would fill the bill and have something to carry, save the company 'oodles of money, and make the traveling public so glad that they would sit down on the cold ground and laugh for joy.

The Tail examines firemen before they are set up, and his word goes with the "old man," and I give the boys, who expect promotion, a pointer that the escorting of the younger Tail girls to a show, the purchase of a few whisky-sours for the Captain Tail, or the agitation of the propriety of presenting the general assistant-everything with a gold-headed cane, will go much farther with him than knowledge of valve gear or train rights.

I was in his office lately while two young men were examined.

The first fellow that came in was one of our best firemen, decent, sharp as a pickerel, and deserving of promotion.

The Tail started in thus:

"Well, young man, can you run an engine?"

"I think so."

"That's no answer. What's lead?"

"Opening of valve when engine is on dead center."

"Who told you? You've been studying for this. What's coal?"

"Composed of different substances, principally carbon."

"What's a parallelogram?"

"A figure whose opposite sides are parallel."

"If you was getting up an engine to pull 100 cars on a level, what size cylinders would you use?"

"I don't know; don't expect to build any engines this fall."

"Well, what size stack would you use?"

"I don't know."

"Don't know?"

"No."

"You're a bright one, you are. What size stack do they use here?"

"Sixteen inch."

"Sixteen inch; that's right. Used that on the Hudson Bay while I was traveling engineer. Six-

"Yep, betcherlife they can't play three ball with us."

"Well, Jim, what's steam?"

"Hot water."

"Pretty hot, ain't it, hey, Jim?"

"Yep."

"What's coal?"

"Stuff to burn."

"Yes, course it is. What's the difference between anthracite and bituminous coal?"

"Different kind."

"Yes, yes. Say, Jim, what's lead?"

"To put into valves."

"Yes, course. How old are you, Jim?"

"Thirty-two."

"Yes, yes. Well, Jim, I just ast you a few questions to see how you was gittin' along. You go over into the stock yard and run Biles' engine to-night, and I'll git ye on the road pritty soon. Well, yes; don't care if I do, Jim, smoke it after supper."

Exit firesy No. two.

"Likely young feller, that," says The Tail to me; "make a good runner, too, you bet. Father fired for me on the Hudson's Bay, married a sister of

fired and sued for trespass if they walked across the company's right of way.

He sat up behind me last Saturday as the best engine in New England was skimming 61 miles an hour out of four mail cars, and said:

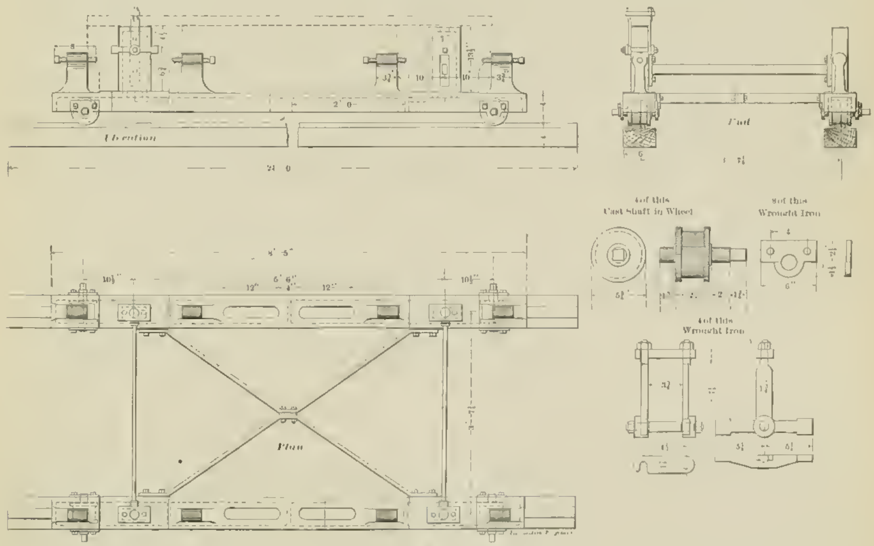
"Too small cylinder, Alexander; too darn small, running line and line, and only three-fourths lap on a five-inch travel. I just wish I was master mechanic of this road. I'd show 'em something. This engine wants a short stroke, big cylinder, twenty-two by twenty-two, and a seven-and-a-half or eight-inch travel. They could take down half their coal chutes then. But, Lord, the old man is slow to move things."

I was sorry, Mr Editor, we got into the passenger station at the Hub just here, or the old Tail would have had a place picked out for his wife—possibly running my pet engine. JOHN ALEXANDER.

Lamp and Whistle Question—A Reasonable Explanation.

Editor The Locomotive Engineer:

I would like to say in reply to R. W. Pope's letter in the February LOCOMOTIVE ENGINEER, that the reason why the whistle of a certain locomotive



NORTHWESTERN KINKS, TRUCK TEMPLATE.

teen inch is the right sized stack for any engine. You'd better study up a little. How old are you?"

"Twenty-four."

"Too young, too young altogether. I wa'n't set up till I was thirty. What's the best, single or double nozzle?"

"I suppose it depends on the service; one kind seems to do as well as another."

"Tut, tut, man. The Hudson Bay abandoned single nozzles thirty year ago; they ain't no good. You seem to have no very good idea of what a thing ort to be."

"Single nozzles work well on this road."

"They do, hey? That's all you firemen know. Why, my dear sir, I'll guarantee to save two ton of coal a day on every engine if the old man would let me introduce double nozzles. Done it right on the Hudson's Bay. But look here, young fellow, you want to post up, and maybe after awhile we can put you to running. Good morning."

Exit bright young man, feeling mean and misjudged.

Enter second fireman.

"Hello, Jim; glad to see you. Want to be examined, hey? Well, that's all right. Say, you fellers got the best of Mart and Bill on that run last night, didn't yer?"

mine. That man knows more about water than any man in New England. If I could get the old man to make him superintendent of water supply on this road, he'd make a turning over in that office—you bet he would—and save this company ten thousand dollars a year—do it just like a darn. Heard you was off the track last night. What was the matter? Broken rail, so? There is a damnably managed department. Pete White don't know no more about keepin' up track than I know about preachin'. What they want to do is to get a man like Ike Merrill on the Hudson Bay. Why, he forgets more about track every day than Pete White ever knew; takes right hold himself. Great Scott, but wouldn't he make things howl here! You wouldn't see four or five dude clerks in that office long. Yes, Johnson is roadmaster now. Ike's keepin' butcher-shop in Collins; but, Lord, he'd be willin' to take hold of the place. You ort to mention this to the old man, John; it would be a good thing for the road—a big thing, sir. I can recommend Ike, he's my wife's father."

The Tail, being general factotum, goes out on the road as sort of engineer in general, and paralyzes firemen by telling them that if they had fired or cleaned their engines on the Hudson's Bay as they do here, whilst he was traveling engineer, they would be

put out his office lamp, is that the pitch of that whistle was a harmonic of the tone that would be produced by the lamp chimney if it were used as an organ pipe, so that when that whistle was sounded, the air in the lamp chimney vibrated in *sympathy* with it.

This law of tones is well understood by organ builders, and if any engineers have trouble with their cab lamps going out when the whistle is sounded, I think they can remedy it either by changing the pitch of their whistle or the lamp chimney for one of a different length.

Grand Rapids, Mich. D. EMERY.

To Save Work in Valve Setting.

Editor The Locomotive Engineer:

Brother L. C. Hitchcock is correct on valve motion, but he will save himself time and trouble if he will only use centers on one side and quarter on the other, and he will find out he has the same results. E. A. CAMPBELL,

Houston, Texas. Supt. M. P. & Machinery.

Phelan's Air-brake Practice is meeting with quite a sale in Australia. One of our club raisers there recently sent in an order for 60 copies.

LOCOMOTIVE ENGINEER.

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NEW YORK, MARCH, 1891.

CONTENTS

Chances for Economy in Higher Pressures or in Compound Locomotives.

Those who are inclined to the belief that there is little or no economy in compounding locomotives, generally end their argument by the assertion that simple engines could be made just as economical, if a very high pressure were carried.

A great many of our roads have increased the boiler pressure up to 170 or 180, and one English road has some boilers carrying 200 pounds per square inch.

We have not yet heard of a compound locomotive for which a considerable saving of fuel was not claimed, and, in most cases, proven. The best example extant is the little Forney engine on the Brooklyn elevated, that was compounded by the R. I. Locomotive Works The tests this engine has undergone prove that she is saving from twenty five to thirty-five per cent. of fuel over the simple engines of her own class, but there is a good reason for this showing, and it is larger than the same makers, or any one else, can hope to get on a surface road, in express service. The elevated engines are employed more than half the time they work steam in starting and getting their train up to speed. This calls for the working of the engines hard, the lever in the corner for a few turns, then gradually hooked back a notch at a time until, when cutting off at a quarter or a third of the stroke, they must be shut off for the next stop—stations being only five blocks apart. This sort of use of a simple engine is very wasteful of steam and fuel, as any one can see.

Now, the compound engine works steam expansively, even while in the corner, and though she starts a train slower, makes up for this when she gets it going; the construction of the engine obliges the runner to work her expansively even in starting, prevents a fierce blast from tearing the fire, and gets more useful work out of the steam.

This compound locomotive shows a very high saving of fuel, because the engines she runs against are so wasteful of it

The Webb compound on the P. R. R. shows a large saving over the regular engines of the road, and, we believe, partly from the same reason. Webb's compound locomotives do not show as high a saving of fuel over his own simple engines as it does over ours. Why? Because his simple engine is more economical than ours.

A comparatively high pressure of steam can be carried with good results on the boilers of compound locomotives, because by expanding the steam in two cylinders a large percentage of useful work can be got out of it.

The same pressure in a simple locomotive is not economical, because it has to be released from the cylinder before it has done as much work by expansion as it would do in the compound locomotive's cylinders. Too much heat is thrown away in the exhaust, the fire has to be forced harder to furnish this extra heat to waste, and everything about the engine and boiler must be made heavier and stronger to stand the pressure Again, the chances for wasting steam are greater with high than moderate pressure—every leak is intensified, and there are more leaks.

High-pressure steam for economy should call for a shorter cut-off, but the limit of cut-off for effective work, easy riding, and the prevention of excessive compression with the link motion is found between the quarter and third stroke marks—6 or 8 inches for 24-inch strokes.

If we are debarred from an earlier cut-off, we must wire-draw the steam more by throttling. We may gain a little here by superheating the steam in wire-drawing, but we reduce the pressure at the chests—why not carry the lower pressure in the boiler? It is certainly cheaper on repairs, and safer.

The new "Class P" passenger engines on the Pennsylvania carried 180 pounds pressure, and the boys had to "hit 'em" to make time. But two of these engines blew off their dome caps, and, pending a change of pattern, the pressure was slacked back to 140 on all the class, and they have made the time just as well as before

There must be a pressure for every locomotive that is just right, taking into consideration her size, weight, service required, and not forgetting the link motion—which cuts a large figure. We are inclined to think this happy medium exists, for the simple reason that by going to extremes, in either direction, trouble is encountered.

Suppose we had fifteen pounds pressure, and there was no such thing as friction, this pressure would move the pistons through the cylinders, and when the exhaust took place a very large amount of heat would be wasted, and yet no useful work could be done.

Now, on the other hand, if we had one thousand pounds pressure, we would be unable to use it in the cylinders, because we would not have the weight to maintain adhesion, everything would have to be extra strong, and the dead weight carried to stand the pressure would be more than doubled from present practice; we could not cut off much earlier than we do, and steam would have to be reduced to the cylinders; the cylinder condensation would be greater than at a later cut-off, and the excessive heat would make the lubrication of the valves and pistons almost impossible.

Do the best we can, the development of power by any heat engine is wasteful, in so far as we get the use of but a small per cent. of the heat in the fuel consumed.

In the use of steam, we are a good deal like the small boy who hitches his little sleigh on behind the four-horse sled, and is dragged along, consuming but a small part of the passing power

Compound locomotives can carry higher pressure and get more work out of steam than can single expansion engines, and when simplified and adapted to our work, will become as popular for locomotive work as is the triple expansion engine for marine work—because they will haul more tons a mile, or one ton more miles for a ton of coal burned, than simple engines will.

The present form of locomotive with excessively high steam pressure will not become as popular, because the railroads will measure its work by the tons of weight moved a mile, or the miles a ton of weight is moved for a ton of coal consumed—and it will not be able to compete with the machine that makes its second expansion of steam in a cylinder instead of in the smoke-stack.

Five Thousand Dollars Reward.

It has become a very common practice, of late years, for railroad officers to get out flaming handbills, after a wreck, offering five or ten thousand dollars reward for the arrest *and conviction* of the miscreant or miscreants who placed obstructions on the track, or misplaced a switch.

Sometimes, no doubt, these posters are gotten out to terrify meddlesome people in the district where a wreck has occurred, but in many, if not most cases, the sole reason for their existence is to shift the responsibility for the fatalities from the shoulders of the road, or its management, to the shoulders of some unknown and undiscoverable "miscreant."

When an engineer or fireman, or both, are killed, it opens a cheap way of settling with the family, if the road can make the wife and children think that the dear one was ruthlessly murdered by an assassin in ambush, whom the more than interested railroad would give $5,000 to get and send up—or hang

"Miscreants, to us unknown," are charged with about twenty crimes for each one committed.

The writer recently walked through a yard in a small town on the line of a road that had up a "$5,000 Reward" notice. There were stub-rail switches, with broom ended rails from four to six inches, apart. One switch stand we inspected had the bridle rod connected to the stand with a bolt not less than a quarter of an inch smaller than the hole it was in, and the slack of the rig, from the padlock to the rail—by actual measurement—was one inch and an eighth. Four out of seven ground switches were so made that the center of the rail rod connection was *above* the fulcrum, instead of below it. Such a switch will throw itself under a train There was enough slack in switch-connections to cause a disastrous wreck any time—one of the $5,000 kind.

Every freight train that passed had flat wheels enough under them to break dozens of rails any frosty day. Brake beams were small wooden ones, and many running without safety hangers.

This road has power brakes only on its passenger cars, lights its cars with oil lamps, and heats them with stoves. It has half-protected drawbridges, uses little, four-inch switch-lamp lenses, that are invisible about ten car lengths away in good weather.

This road keeps enginemen and train crews on duty from sixteen to thirty hours continuously, and its officers are the very kind who call a washout "an act of Providence," and foster the framers of resolutions that say, "It has pleased God to remove from our councils our beloved brother," etc., etc. They are the first to lay a case of bad switch, or rail-spreading wreck, a burned bridge, a broken wheel, or brake-beam "pile-up," to that unknown quantity, the "miscreant," for whose arrest and conviction they would gladly give $5,000.

The widow or mother of the victim of these wrecks generally sign a clearance for from $250 to $1,000—miscreants come higher, and are very rare

A little intelligent investigation of the cause of wrecks by the men most interested—the enginemen—and quiet advice from them to the proper officers of where there are dangerous places or practices, would do a good deal to prevent these fatal wrecks by the stitch-in-time process, and when they did occur it would probably put the responsibility where it belongs, instead of charging it up to Providence, or the $5,000 "miscreant" aforesaid.

Book Review.

CONSTRUCTIVE STEAM ENGINEERING A Descriptive Treatise, embracing Engines, Pumps and Boilers, their Accessories and Appendages. By Jay M Whitham, M E., C. E John Wiley & Sons, New York. Price, $10.

This work treats of the constructive features of steam engineering; it does not discuss the subject of designs, but illustrates and describes the distinctive features of almost all the popular builds of engines, pump, boilers and general steam appliances. The work shows the latest and best devices used by the most successful builders, and does not advocate, like many works, untried plans and devices designed by the author because they were different from anything else.

The book is a bound catalogue of standard makes of steam machinery, compiled by a disinterested and unprejudiced mechanic No better work on machine design can be got out than one showing the latest and best forms made by the most progressive builders.

The work is large, having 900 8vo pages with 795 illustrations, many of them folded plates The work does not treat of locomotives.

COMPOUND LOCOMOTIVES By Arthur T Woods, M M. E, Prof. of Mechanical Engineering, University of Illinois R. M Van Arsdale, publisher, 140 Nassau St, New York Price, $2

This work is made up of twelve chapters on the subject of compound locomotives, contributed by the author to the columns of the *National Car and Locomotive Builder* during 1889 and '90, making a book of 170 pages, containing quite a number of engravings illustrating the distinctive features of the different forms of compound locomotives now extant

One very useful feature of the work is a list of all the patents granted on the compound locomotive from 1882 up to August, 1890.

The author has not "theorized" very much on the subject, but has rather confined himself to a brief statement of what the different experimenters have done, and the results of trials of their devices

The work will be especially useful to master mechanics and mechanical engineers who contemplate experiments in the direction of compounds.

ASKED & ANSWERED.

(20) E. L. Baltimore, Md., asks:

Why is it necessary to have a vacuum pump connected with the passenger car steam heating apparatus as used on the P R. R system? *A*.—The pump is not necessarily a vacuum pump; it is used to pump the water of condensation out of the train pipes and radiators, and put it back in the tank, thus maintaining a circulation

(21) Y. B., Durham, N. C., asks:

Can a locomotive's drive wheel be properly counterbalanced for various speeds, and how? *A*.—Strictly speaking, no. Speed is not usually taken into consideration in determining the weight of counterbalance; no doubt there is one certain speed at which any engine's counterbalance is nearest right

(22) J. F. M., Salida, Col., asks:

Please state in your question column what book or books you would advise a person to get in order to find the exact positions to set the saddle on the link. *A*.—Auchincloss on Link Motion, sold by E & F N Spon, 12 Cortlandt street, this city.

(23) Young Engineer, N. Y., asks:

Why does lead increase with the link motion, when lever is cut back? *A*.—Because the relation of the rest of the valve gear to the eccentrics is changed just as if the eccentric were advanced on the shaft. By lifting the links, the straps and entire motion are set *back* on the eccentrics. The shorter the eccentric blades, the more movement takes place and the more lead will increase.

(24) Inquisitive, Weldon, N C., asks:

Why is it that elevation from sea level causes water to boil with less degrees of heat? *A*.—Water boils when the tension of its vapor is equal to the pressure it supports. As the pressure is increased so is the boiling point, as it is decreased the boiling is also decreased. Simply stated, because there is less pressure on the water; the pressure of the atmosphere is 14.7 pounds per square inch at sea level and becomes less at greater heights.

(25) B. & O., Mt. Clare, Md., write:

We are using the Westinghouse improved automatic freight brake, and often are obliged to cut out cars on account of air leaking through the exhaust, or, in other words, through the pressure-retaining cock on top of roof. What causes this? *A*.—The alleged leak is probably simply the air releasing through the cock, as this is the only place it can release when car is fitted with retaining valve Many accidents have been caused by men cutting out cars because they thought the air ought to escape at the top of the car only when the retaining valve was turned on. The fault is with the men, not the device.

(26) J. H. D., Kalkaska, Mich., asks:

1. Why are the top guides worn the most? 2 Which is the stronger, a double row of horizontal rivets or the zig-zag rivet plan? *A*.—There is more pressure on the top guides when the engine is running ahead; engines that back up all the time wear the lower guide the most. The crosshead and guides are to keep the connection between the piston and main rod from going up or down out of the direct line Just think for a moment where the force is applied and the resistance met, and you will see where the pressure on the guide is in either case 2 The staggered rivet seam is the stronger

(27) Tar Heel, Weldon, N C., writes:

I am running an engine with eccentrics 5½" throw. Suppose I turn ⅛" off of this eccentric all around. Will it shorten travel of main valve, and how much? *A*.—No Just think for a minute yourself; the *size* of the eccentric makes no difference with the throw; if your eccentrics were ten feet diameter the distance from the *center of the axle* to the *center of the eccentric* would not be changed, and this alone determines the amount of throw If you made two eccentrics, or rather wheels, one ten feet and the other ten inches in diameter, and put the shaft in the center, neither would move an eccentric blade, because there would be no eccentricity—but set each axle out an inch, and each will have two inches throw.

(28) J. S. L., Des Moines, Ia., asks:

Will a locomotive pull more than half a train with main rod disconnected on one side. If so, why? Do you not think it would be better to take a train that you are sure you can handle without taking chances of doubling hills with an engine working on one side? *A*.—A locomotive on one side can pull more than half her usual train, because the boiler will furnish steam to work one cylinder very much harder than it is possible to work both when coupled together, and the engine has use of all her adhesion The difficulty is to get train started, and the weight of load should be regulated somewhat by the number of stops, and where they are A train so heavy as to require a double should not be taken under ordinary circumstances. A locomotive on one side is more or less unmanageable, and liable to stop on the center in the way of important trains.

(29) A H. Tucker, Chillicothe, Mo., writes:

Will you please answer through the "Asked and Answered" column the following: What is the minimum quantity of water that a Sellers No 7 injector of the "76" pattern will supply to a locomotive boiler at a boiler pressure of 140 pounds per square inch, feed water at ordinary temperature? What is the maximum quantity? What is the size of the delivery tube opening? *A*. The No 7 Sellers of "76" will deliver at its minimum capacity, with 140 pressure, about 94 cubic feet of water per hour, and at its maximum capacity 201.5 cubic feet per hour It will heat the water about 100 degrees The size of delivery tube is seven millimeters. All injectors are numbered by the size of the smallest tube in millimeters One millimeter is .03937 of an inch, to find the size of any injector in decimals of an inch multiply .03937 by the number of the instrument.

Ever since the Santa Fe road built across the Southwest there has been a curious practice followed in regard to the employment of Mexican labor. A wiper received $1.35 per day, unless he was a Mexican, in which case he received $1.75. When Mr. Player went there he made the pay uniform, and all the Mexicans struck. It is peculiar that this practice was carried on for so many years, and no one seems to know the reason for the original favoritism

John Wiley, the well-known scientific book publisher, is dead He was eighty-three years of age.

Who Is Responsible for the Harlem Tunnel Disaster?

On the morning of February 20th two empty passenger trains at the Grand Central station in this city, were put together and taken by a switch engine toward Mott Haven, where the trains are switched and cleaned. This particular morning was very foggy and signals hard to see, and before the heavy train of empties was through the tunnel, it was run into from the rear by one of the New Haven trains, and six car cleaners were killed—some of them being roasted alive.

Between Fiftieth street and Ninety-eighth street on the Harlem Railroad there is a tunnel under Fourth avenue, being about half open to the streets by an open cut in the center of each block, there are four tracks through this tunnel—the two central ones for the line roads, the outside tracks for local traffic—it is used by the Harlem, the New York Central and the N Y, N H & H. roads; all trains on this piece of track being under the superintendent or general manager of the Grand Central Depot.

The Harlem road uses the left-hand track instead of the right, and the signals are located upon the left of the track, so that they are on the firemen's side.

The road is blocked by what is known as the Syke's system of signals, the switches and signals being interlocking. There is an electrical device that locks signals in the danger position, and the signal cannot be taken off until released from the other end of the block—it is said by those who ought to know, that in order to hurry traffic it is customary for the operators to resort to a trick of their own whereby they can unlock the signals by using a pencil, and that two trains are allowed in blocks at the same time very frequently

The New Haven train was running at a high rate of speed and the shop train very slow when the crash took place—one car was completely telescoped and at once caught fire, burning dead and alive alike until the arrival of the city firemen, who put out the flames.

The daily papers have made a great howl about the New Haven road not using steam heat, but it is very evident from the wreck that the fire was intensified, if not caused, by the oil in the head-light.

The collision occurred at Eighty fourth street, in the block extending from Seventy-second to Eighty-sixth street.

The engineer either ran by the distant and home signals at Seventy-second street, or else the signal was not against him Either the engineer or the signal man at Seventy-second street is guilty of a misdemeanor, and on the final decision the cost of the accident will fall on the road employing the man adjudged guilty.

Let us look into the why and the wherefore of this business. But first let us say that we have no interest in the matter further than to see exact justice done, if the engineer is guilty of gross carelessness let him suffer and his road pay, or if the signal man is to blame, on him let the hand of the law descend. We are sorry to observe, however, that the matter, as far as the public are allowed to see, has settled itself down to a contest between the legal talent of the two roads, to see which can shift the cost of the accident upon the other.

The signal operator in his tower has charge of the operating of the signals in such a way that no two trains can get into the same block, or in such a way that the trains will not run into each other, his reputation with his superior officers depends upon how little he delays trains, and there is a constant incentive to be as attentive to the prompt removal of a signal that will stop or delay trains as possible.

With a young and ambitious man there is a constant temptation to take a few chances, to be "fly," depending considerably on the engineers and the air brake to lessen the danger of collision, and there is no direct check on this tendency, as cases are not reported and success emboldens the experimenter The signal man is in no personal danger, and "lightning only strikes once in a thousand times."

How about the engineer? He is in the greatest personal danger, his years of training on a locomotive tell him the consequences in case of collision, and he knows full well that his chances of escaping unhurt are but about one in ten. No sane man is going to jump into a furnace or down a well. Aside from that, his fireman is just as much interested, for he takes the same chance, and knows full well that not only their success but their very lives depend upon their being *sure*, not only about the engine, the brakes and the orders, but, above all, the signals, not only that they are *not* wrong, but that they *are* right.

In the Harlem tunnel there is no firing allowed—the fireman has no duty but to look out for signals—they are on his side. In thick weather he must stand in the gangway and stoop down to see the distant signal at Seventy-second street, because it is so low.

Bad weather often obscures these signals, and in order that there may be an additional safeguard a large gong is so arranged as to ring continuously while the home signal is set at danger. Every one who has had experience on a locomotive or train knows that such a thing as a noise like this gong being "drowned by the roar of the train" is utterly impossible.

On this particular morning Engineer Fowler and Fireman Wellington started with train No. 10, known as the New Haven local; they were five minutes behind the shop train. Fireman Wellington was in the gangway on the lookout for the dwarf distant signal at Seventy-second street; the engineer had to go to the left side of the engine to see the signal, and the fireman also reported the signal "clear." Both men positively declare that they saw the home signal at "clear," and say no bell was ringing; the conductor says the bell was not ringing when the train passed, and several passengers say they heard no bell.

The signalman and a track walker who was with him are just as positive in their assertion that the signal was at danger and the bell ringing. It is not possible that the engine crew were asleep; they had been less than five minutes away from the terminal station.

No sane man would pass that danger signal knowingly—it is too much like suicide—personal danger prevents the engineer from taking chances, while there is no personal peril to check the assumption of risk in the signal man.

President Depew, of the N. Y. Central, says the accident was caused by the N. H. train running too fast—the time card calls for high speed in this tunnel. This train's time is thirty miles per hour, and the officers of all the roads brook no delay; there is not a day in the year when there is not some train that runs fifty miles an hour in this tunnel. Manager Platt, who controls this short piece of busy road, says the signals do sometimes fail, but on the side of safety, and acknowledges that it is possible for an operator to unlock the signals, and the rules provide for this in the use of a "twelve bells" signal that signifies, "Have unlocked you"; this is to be used when the block system is out of order.

From a personal investigation we are satisfied that the signals were at "clear," no matter in what condition the operator thought them. He may have cleared another signal thinking he was clearing one of the main tracks. We are also convinced that two trains are sometimes allowed in the same block, and this fact ought to have been known to the operating officers. While the block system used was the best one once, it is not the best now, and has a disadvantage in that it can be tampered with. There are in successful use systems of block signals that are operated by electricity or air and electricity, that are entirely automatic, being set and released by the trains themselves. They cannot fail except they go to danger, and there is not the chance for human forgetfulness, carelessness, or design in their handling, that exists in the old hand-operated block signal.

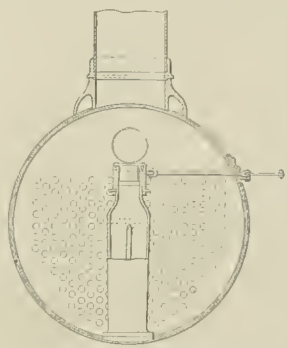
A road, crowded as this one is, should be provided with absolute blocks automatically operated by the positions of the trains themselves. The practice of running trains on the left-hand track with the signals on the opposite side of the track from the engineer is a very dangerous arrangement.

If any one erred in judgment or made a mistake, it looks as if it must have been the signal man, and not the engineer, but these two men are not entirely to blame—the road with the poor signal system is a partner in the crime, and signal men only get $52 per month.

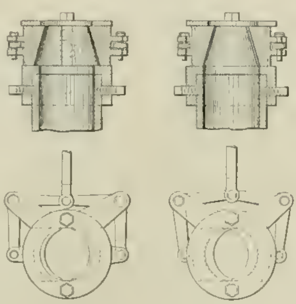
Whether the car stove caused the fire or not, we hope the New Haven road will have to pay a big fine for using them in New York against law—they are dangerous, and no good road ought to, or will, insist on stoves.

It is only fair to say, however, that the New Haven officials had given an order, before the wreck happened, for the most expensive steam heat appliances extant—as good as money can buy—they commence on March 2d to put on the Consolidated Car-heating Company's Disk Drum System, using the Standard Sewall Coupler.

There is another element that ought not to be overlooked, and that is the use of "rules" for the government of employes that are habitually ignored by the men, and must be, in order to get trains over the road on time. These rules are intended and used only to shield the road from responsibility and the payment of damages in case anything happens. Rules being daily ignored are winked at by the officers. There may have been none of this in the tunnel disaster, but there are very few roads in the country where a good hunter could not find from one to a dozen of these rules that should be obeyed and accidents avoided—yet if a man obeyed them he would be taken off his run, as a man who could not make time. Have you a rule of this kind on your road?



Section through A. B.



Valve open Valve closed

VARIABLE EXHAUST NOZZLE.

Variable Exhaust Nozzle.

Annexed engraving shows a very simple and practicable form of variable exhaust nozzle invented by Mr. D. Hanney, a mechanic in the Chicago & Northwestern Railway shops at Chicago, and used on some of the locomotives on that railway. A valuable feature about the invention is that it can be easily operated from the cab, and by that means easily adjusted to the requirements of steam making. Another good point about the invention is that the exhaust orifice is not distorted in shape by being opened or closed. An expanding nozzle is particularly valuable for locomotives engaged on suburban business if the men in charge could only be induced to operate it. A careful test of this nozzle was made with one of the suburban engines, and a material saving of fuel was effected by its use. The saving recorded was about 20 per cent. After making allowance for the saving that always ensues when men are working under the consciousness that they must do their best, there appears to have been a margin of saving, due to the variable exhaust nozzle, which should induce railroad companies to adopt it.—*National Car and Locomotive Builder.*

At the Illinois Central Shops.

The old shops of the I. C., on the lake front in Chicago, are landmarks to every railroad man who has spent any time in the greatest railroad center in America.

The I. C. is a big road, running almost due north and south from New Orleans up into Wisconsin; they own almost 2,000 miles of track, and control, through stock ownership, or lease, 600 miles more. There are in service 500 locomotives, and over 18,000 cars.

The shops in Chicago are old ones, and have a great many old tools and appliances, but there are also many new ones, and a practical man can see at a glance that there are minor improvements going on that are tending to facilitate the handling of material and save time. Overhead tracks and trolleys are being built, and cranes placed in the most convenient places.

W. H. V. Rosing has recently been promoted from chief draftsman to be assistant superintendent of motive power, and to him has been given the care of the shops.

The first novel thing that catches the eye as you go into the machine shop is a jig for milling out steam ports in cylinder castings on a large radial drill. The jig is simply a cast-iron plate or template bolted over the valve seat, having ports cut out of it, of the proper proportions. The cylinder is fastened on the bed of the drill, and the radial arm set at right angles to the bore, and a milling tool the desired width of the ports put in, in place of a drill; the blank above the cutting edges, or the shank, fits the slot in the plate bolted above the seat, and this guides the tool, the automatic feed of the machine feeding it from end to end. For the exhaust port they do not change tools, but feed the same small miller right around the port.

On the driving-wheel lathes they use a very neat and handy hoist to lift the wheels to the centers. This device consists of two hangers to take hold of the axle, a bar for them to hang on between the face plates, and two boxes to support the bar, the whole rig being placed on the lathe itself. The boxes are simply two square pieces of iron, with a hole through them for the bar, which is long enough to reach from one face plate to the other, and heavy enough to support a pair of wheels. The square pieces have squared shanks about ten inches long, that drop into the ends of the large radial slots in the face plates. The hangers hook over the bar, and the lower end terminates in a fork large enough to go over any axle, and a heavy key is put through the fork below the axle, to lift the pair of wheels. In the center of these hangers there are turn-buckles to adjust their length. The wheels are rolled up behind the lathe, the boxes put into slots on the upper quarter of the face-plates, the cross-piece put on, and the hangers adjusted the proper length and keyed to the axle, then the lathe is started up, and the wheels roll up inclined timbers until they are above the bed of the tool, and then swing clear; the lathe is stopped with the boxes on top, and the centers run into the center holes in the axles, the turn-buckles slackened, and keys knocked out of the hangers, and the whole rig taken off in just about as much time as it takes to tell how.

Where no crane is at hand, this is a very handy device for the work, costing little, requiring very little machine work and no patterns, and enabling the latheman to handle all his own work alone.

They bore out driving-boxes very successfully in the quartering machine, a field of usefulness not often given that machine.

In the machine shop there is a very ingenious tool gotten up here for making tin car seals, stamping the initials of the road and a number into the tin, which is fed in—in sheets of the proper size

In this shop each swing crane—and there are several—are so set as to serve three or four tools each.

This road has a good many kinds of engines, most of them having some of the peculiar features found of benefit to the road. The water contains a large percentage of lime, and forms scale very readily, and there are peculiar washing-out facilities used. On the left-hand side of each boiler just ahead of the crown sheet, and on a level with it, there is a cock screwed into the boiler shell This cock is a check, the pressure in the boiler tending to keep it shut, there is a cam, however, operated by a rod to the cab, that will open it when there is pressure on the boilers, this allows it to be used as a blow-off cock

Inside the boiler there is a pipe extending from this check across the boiler, the opposite end being closed, and a number of flattened jets screwed into the back side of it. Outside the check there is a pipe, with a hose coupling extending below the running board. When the boiler is washed out, the hose is connected to this pipe, and the pressure from the pumps lifts the check, and the jets direct the water under the crown bars and wash the sheet clean. On the belly of the boiler, near the front end, there is another hose connection, and an elbow inside the boiler that directs the stream back, this is used after the general washing, to drive the scale loosened from the flues back into the water leg, where it can be taken out of the hand-holes.

A great many of the engines have their checks in the front side of a steam dome placed well ahead. These domes formerly had an alleged water purifier in them. A sort of basket, containing iron turnings and small scrap, was supposed to receive the deposit of lime; the dome caps were taken off periodically, and the scrap changed, but, while there was always more or less deposit on the scrap, the practice was abandoned as being too much bother for the results obtained, the checks being left in the dome.

All driving-boxes are cast around strips of brass that form the bearing, these are dovetailed, but sometimes come loose when they are driven out and shimmed up, or new ones put in.

They have here a class of heavy suburban engines that do remarkably good work. They are four-wheel connected, have a pony truck in front, and a four-wheeled truck under the tender, which is framed with the engine

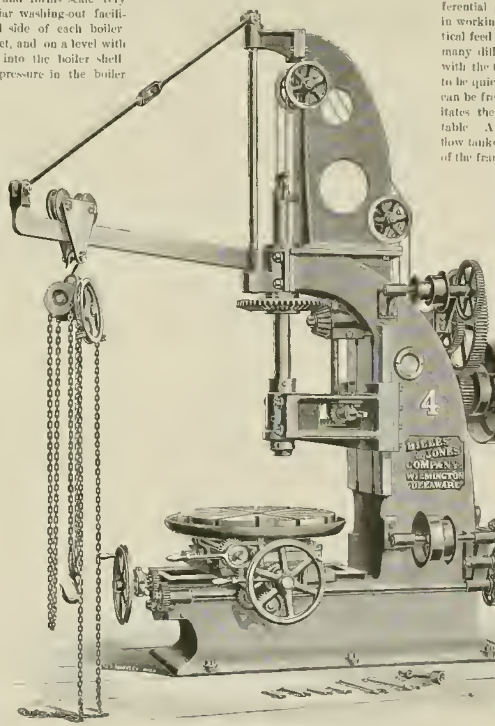
To prevent dirt and the rusting and pitting of the sheets of the tender, the manhole is placed on top of a large cast-iron elbow that is flanged to the back of the tank, when this is run over, the water goes upon the ground, and the coal space is free and dry. The pony trucks on these engines have a long equalizer on each side, extending back between the steam chest and the saddle.

Out in the graveyard there are some old-timers of small caliber that have died of the grippe, and on stilts a dome boiler of the vintage of '46 reminds you of the "merry old days that were."

The new engines are mostly of the Brooks build, and are very nice engines indeed; they have inclined fire-boxes, with a section of level grates at each end, and a section in the center on an incline, all shaking, they are well liked by the men, who have dubbed them the "toboggan fire boxes."

The standard grates used run lengthwise of the box, and are simply straight bars with projections on the sides, and in shaking move fore and aft

All piston heads are cast solid, with four core holes; these holes are tapped out, and stays screwed through and riveted down.



A NEW DESIGN OF VERTICAL MILLING MACHINE.

Jerome packing of their own make is used.

All eccentrics are four-inch face and 16 inches in diameter, so that but one size of eccentric and strap need be carried in stock, and they can be kept on hand finished

In the roundhouse, the valves on wash-out plugs are moved by an eccentric held open or closed by a weighted lever, which is easy and quick to handle

The buildings are mostly of stone and brick, but have been in use for many years, and are therefore not so modern as you could wish, new shops will probably be built at no distant day, further out. Plans were in the drawing room, to which chief draftsman D. J. Durrell was putting the finishing touches, for a very fine plant at Water Valley, Miss., to take the place of the shops recently burned there.

On some of the engines the New York air-brake is used, at the time of our visit we noticed a mechanic filing back one of the stops on the engineer's valve, the system of levers in the valve having developed lost motion enough to make this necessary

On all the engines running into the city there is a blower valve, located so that when the throttle is closed, the blower is started enough to prevent black smoke, the amount of opening given the blower being regulated by a thumb-screw on the throttle lever.

A New Design of Vertical Milling Machine.

The well known builders of locomotive and car-shop machine tools, Hilles & Jones, of Wilmington, Del., have recently put on the market a heavy vertical miller, originally designed for locomotive work. The machine has some new features that will, no doubt, be duly noted at a glance by practical men.

There is a self-supported radial crane, with a differential pulley block and trolley for convenience in working The spindle is arranged to have a vertical feed by hand, which is very useful in facing many different pieces. The worm which engages with the table has a pivoted shaft which allows it to be quickly moved out of gear, so that the table can be freely revolved by hand This greatly facilitates the work of setting pieces to a line on the table A rotary pump, with the necessary overflow tanks, which are attached to the opposite side of the frame from that shown in the cut, returns the soda water which is used in keeping the cutters cool. There is an unusual vertical height in this machine, the vertical motion of the spindle being 20 inches

This allows a great variation of work to be handled, which otherwise would have to be done on a slotter, or by hand. The merits of vertical milling are well known to most of our readers, and need no special commendation in this description.

Baldwins are now delivering twenty-seven locomotives to New South Wales, Australia. The price was $10,000 each.

The Bennington & Glastenbury Railroad in Vermont has the steepest grade on which ordinary traction locomotives are used in the United States. For some distance the road rises at the rate of 250 feet to the mile.—*Railway Register*.

What is the matter with the Calumet branch of the Denver & Rio Grande, with its eight miles of over 300-foot grade—part of it 400?

The Employes' Relief Association of the Philadelphia & Reading reports an increase of membership during the year to November 30, of 1,500, and it is stated that *ninety-eight per cent* of all the employes of the company are members of the association, which would seem to indicate that membership is in some degree compulsory—a point which was considerably controverted in the newspapers during the earlier months of the association's existence. The total contributions to November 30 last were $44,833; payments for deaths and disablements, $275,488.—*Ex.*

The St. Paul & Duluth road give any employe, engineman, machinist or wiper $10 extra for every cracked side rod found—none get away for want of thorough inspection Eight have been discovered in the past two years. It pays the company to find them before rather than after they let go. It is a regular practice on some roads to pay $1 extra for cracked or broken wheels found by car inspectors.

Engineer Louis C. Todd, of the Boston & Maine, has been promoted to the position of master mechanic of the Passumpsic division, and all the boys on the road are pleased and propose to help him to be a success.

They Advertise Advertising.

It's funny how inconsistent human beings can be when they set themselves about it. A shoemaker who wouldn't think of prescribing medicine for himself, and a blacksmith who wouldn't think of making his own shoes, and a merchant who wouldn't think of shoeing his own horse—each because he knew nothing of the trade or art he wished to employ—will all separately and independently sit down to write an advertisement of his own wares or his own work, and when the "ad." fails to attract the amount of custom or trade wanted, our amateur advertisers will each and all hold up their right hands and swear, legally and illegally, that "advertisin' don't pay."

Now, if either of these worthies wanted to build a house he would seek the advice of some one who knew something of house building or get a work on architecture. If he wanted to paint his house mouse color, he would get a painter to mix his paint, or consult a standard work on color mixing. But let it come to the expenditure of money for advertising, and he takes up his pen with as much unconcern as a drunken blind man has for wigglers in the water he drinks. Advertising is a business, and there are men who make it a study, their work is shown in the highest class periodicals of the country—the advertising in some of our magazines being almost as interesting and attractive as is the text—some of it more so.

One concern in this city publish, at 10 Spruce street, a paper called *Printers' Ink*, that is as brimful of kinks and suggestions on advertising as this paper is on locomotives repairs. The little paper costs $2 per year, but it is worth $2 per issue to any live advertiser. The advertisements in railroad papers are too prosy, and not changed often enough. We heartily wish that our advertisers would get a few pointers from *Printers' Ink*, and then commence to bother us to change and rearrange their ads. It would pay them, and it would pay us.

Fast Trains Wanted.

W. Barnett LeVan, a mechanical engineer of Philadelphia, recently read a paper before the Franklin Institute of that city, in which he said:

"It is well known, and has been shown by experiments by M. Regray, superintendent of the Eastern Railway of France, that the fractional losses in locomotives amount to about 35 per cent. of the total indicated horse-power of locomotives coupled by parallel rods. Single locomotives always run more freely and with less internal resistance than coupled ones. The adoption of single locomotives in England has made a saving of over three pounds of coal per mile, or about ten per cent. of the entire passenger locomotive coal bills. The coupling of locomotives tends to keep down the speed. The objection in this country to single locomotives is the traction of one pair of driving-wheels, but by the introduction of steel rails and that of the steam-sanding apparatus, locomotives can now carry as much as 20 tons on a single pair of driving-wheels, where before 14 tons was the maximum load. The fast trains between Philadelphia and New York and those to Washington average about 200 tons weight, drawn by coupled locomotives, the average coal consumption being 50 pounds per train mile. Why not adopt the single locomotive of the English type and reduce the time between Philadelphia and New York to 90 minutes and the coal consumption to 30 pounds in place of 50 pounds per mile? Whatever railroad managers may think of the economy of running light and frequent trains, at reduced fares, there can be no doubt that they are a popular want. The cost of moving trains at any given speed is, all other things being equal, almost exactly in proportion to the weight moved. It can be stated positively, in view of the data before cited, that passenger trains of reduced weights, and drawn by single locomotives, according to the English system, and affording all requisite comfort to the traveling public, can be run between New York and Philadelphia in 90 minutes, and involving a consumption of coal of but a fraction over one-half of that now consumed in making the 2-hour run."

A fair trial of the single coupled engine is needed in this country, just to show what it will do; the results may be startling, but the type will only do for fairly light trains. Instead of howling for faster time, without offering any suggestions on how to get there, Mr. Le Van seems to be something like Blifkin's widow, "Knew what she wanted and wasn't afraid to ask for it."

Credit When and Where Due.

To the Trainmen on —— Division:

Another year has passed without serious accident on this division. Since October 1st, 1888, we have been singularly fortunate in this respect, and I doubt if any road in this country, with as large an amount of traffic, can show so clean a record for any division. During that period you have handled nearly 700,000 cars with a remarkable degree of safety, and while recognizing the excellence of the road-bed, and the good fortune which continues to "stand by" us, I must give all credit to the trainmen whose prudence and good judgment have made it possible. Do not let past success cause you to relax your vigilance and care, but rather redouble it, in the hope of adding another year to the record.

Y. Z. BLANK,
Division Superintendent

The above bulletin was recently posted on the boards of one of the busiest pieces of track in New England. It is manly, and gives credit for work done and results accomplished to the men who wrought—there is none of the "I did so and so" in it. We don't know why—unless it be the enlargement of the bump of modesty—but this officer specially requests us not to give his name or road away.

Better Than a Kick.

Upon the retirement of Master Mechanic McGrayel, on the first of the month, the engineers presented him with a fine bookcase and desk, and the following memorial:

CHICAGO, ROCK ISLAND & PACIFIC RAILWAY—DES MOINES & FT. DODGE DIVISION.

JOHN MCGRAYEL, Esq., Grand Junction, Ia.:

DEAR SIR: We, the engineers of the D. M. & F. D. Division of the C., R. I. & P. Ry. Co., deeply regretting your departure after (17) seventeen years service, as master mechanic, desire your acceptance of the accompanying memorial, in testimony of our affection and respect for you as a gentleman and a mechanic, and as a faint expression of our appreciation of your kindly efforts to render our connection with this division not only pleasant and agreeable to ourselves, but profitable to the company. Deeply regretting that our connection must be severed, we shall gratefully remember our association in the past, and hope always to be held in pleasurable remembrance by you.

J. F. THOMPSON,
M. LEACH,
M. SMITH,
Committee.

Painting the Forth Bridge.

As some curiosity has been expressed as to the quantity of paints and oils used in the construction of the Forth Bridge, the officials of the company requested Messrs. Craig and Rose, of London and Glasgow, who held the contract throughout, to make up a statement of the amount actually supplied, and these were found to be as follows: Machinery and illuminating oils, 980,072 gallons, paint oils, 35,527 gallons; paint, 250 tons. It is computed that the quantity of oil used would have been sufficient to float one of Her Majesty's first-class cruisers, and sufficient paint to cover 1,100 acres, or nearly two square miles of surface.—*Ry. Press* (London).

Some Patent Office Statistics.

The patent office of the United States received 40,201 applications for patents during the fiscal year ending June 30, 1890, which, with the re-issues, designs, trade marks, etc., made up a total of 46,140. There were 25,857 patents granted, and enough labels and trade-marks registered to bring the total up to 27,493. There were 3,403 patents held because the final fee was not paid, showing that some inventors, and, possibly, some inventions, are poor. During the year 11,885 patents expired.

During the 54 years ending in 1890, there were 742,583 patents filed, and 91,165 caveats. There were 475,785 patents issued, and the receipts of the department were $25,349,584; expenses, $20,554,110, leaving a clear gain of $4,095,474. We wouldn't mind running a patent office ourselves.

A Business Way to Do Business.

Our attention has been called to the following neat circular, which shows the estimation the paper is held in and the business ability of Mr. Wade. It would pay any master mechanic's clerk to take this matter up in the way Mr. Wade has—a cash commission is paid for clubs.

OLD COLONY RAILROAD CO.,
OFFICE SUPT ROLLING STOCK,
BOSTON, February, 1891

DEAR SIR: I am getting up a club and I wish to call your attention to THE LOCOMOTIVE ENGINEER. It is a practical illustrated paper for railroad engineers, firemen and mechanics.

This is no job to fleece you; but you will thank me for bringing the paper to your notice.

The superintendent of rolling stock and master mechanic of each division have subscribed and endorsed the same. Shall I add your name to the list? The publication is a monthly, and the subscription price is low, being only $1.00 per year, and will be sent to your address.

By filling out the coupon at the bottom of this circular, enclosing the same in the envelope, and forwarding to me, I will send your name to the publishers at New York.

You can enclose $1.00 with the coupon, or send the coupon and forward the $1.00 later on.

Respectfully,
JAMES H. WADE,
Clerk, Office Rolling Stock Dept.

MR. JAMES H. WADE:

DEAR SIR.—Enclosed find $1.00 for my subscription for THE LOCOMOTIVE ENGINEER.

Name........ Fireman or Engineer.

No........ Street, Town of ....

State of. ....

Magnitude of the Telegraph Business.

There are 842,812 miles of telegraph line in the world, of which the United States operate 254,110. This is lines, not wires. There are 807,589 miles of wire in the U. S. alone. In the U. S. 254,110 miles of poles and cables, 25,591 telegraph offices, and 42,447 employes. The Western Union controls 678,997 miles of the wire. Last year this company alone transmitted 55,878,762 messages. The cash receipts were over twenty two million, and the net profits over seven million.

Russia has the next largest system to the U. S., she owns 88,280 miles of lines, 172,360 miles of wire. The smallest system is that of Paraguay, there being only 100 miles of lines there. The enormous number of 300,000,000 messages are transmitted annually over all the lines of the world.

Many of the oldest of us can remember when there was not a mile of telegraph wire on the earth. We move fast in this age, and see much; but does it make mankind better or happier? The higher the so-called civilization, the meaner men get, the more they will do against their fellows in order to dominate it; the wider the gulf between the rich and poor. No half dressed savage in the wilds of darkest Africa can compete with the civilized men, taking them in the aggregate, of to-day, in cruelty.

Substantial Improvements.

During last year the Illinois Central purchased 89 fifty to sixty-ton engines, built 65 new passenger coaches, which are of the latest design and finish, 1,500 thirty-ton coal cars, 1,000 twenty-five-ton box cars, 10 fifty-foot baggage cars, 10 postal cars, 150 refrigerator cars. It has built and is now building 18 iron bridges, and has replaced 22 wooden bridges with stone culverts. It has built several new depots, and repaired many of the old ones. It has purchased and laid 32,000 tons of seventy-five pound steel rails, and 4,000 tons of sixty-pound rails. It has ballasted with stone and gravel 160 miles of track. It has equipped 100 engines and 2,500 freight cars with the latest improved Westinghouse automatic air-brakes.—*Ex.*

Compound Tubing.

George H. Everson, of Pittsburgh, Pa., has patented a process of rolling tubes that promises remarkable results for many kinds of work.

One of his processes is to reduce a tube by rolling; this process practically polishes the tube inside and out, makes it stronger and lighter; tubes of this kind are used by a factory in Pittsburgh, who make steel carriage and wagon wheels. The other process the inventor uses to roll a lining or a cover or both of a different metal upon or into a tube.

He takes a steel tube and lines it with brass, copper, tin, or any metal, and can cover it with any other metal, rolling the two metals so closely that they are practically solid.

A steel tube covered with copper might be just the thing for locomotive flues in bad water, the covering of copper resisting the action of the salts and making a nice joint in the flue sheet, while the steel lining will resist the cutting action of the cinders drawn through the flue.

Description of the Southern Pacific Compound, by a Sacramento Paper.

The blindest worshipers of the extension arch could not wish for warmer praise than this. Listen to him:

"The combination engine is about completed, and a test of it will probably be made to-morrow or next day. These locomotives have never been used by the company, though on eastern roads they are said to have proved a success. The locomotive in the shops here is an ordinary eight-wheel connection, but with an added front-end extension to the boiler. An ordinary locomotive was taken, and the addition made to it. The purpose is that the steam may be used twice, the combination being of high-pressure and low-pressure exhausts. If it is a success, it will afford a saving in steam and consequently in fuel, by no means a small item in so extensive a system. There will be no added power in the combination locomotive, but the company will be more than pleased if the saving spoken of is effected."

Don't suppose this reporter is any further off than we should be in trying to describe the ladies' costumes at a ball, but a fellow can't help thinking that, perhaps, the reporter had been drinking a little.

Speaking of small steam pipes, ports, etc., the other day, Mr. Wilson Eddy, one of the oldest M. M.'s in this country, said to the writer: "A good many years ago I took an old engine in the shop and lengthened her boiler and frame twenty-five inches; the coppersmith lengthened the dry pipe, but put in a thin piece of metal. After the engine had been in service a few days the engineer complained that she was loggy and would not swing her train after getting it started. The valve gear was looked over, steam ports examined, and cylinder heads removed, to no purpose. The engine would start just as many cars as any other, and pull them at slow speed, but she would not swing 'em. Upon examination of the dry pipe it was found collapsed on account of the thin piece in the splice. The pipe was closed up with the exception of an irregular strip that we estimated to be not over one inch in area, yet this engine pulled a full train over the road in this condition for some time."

More than thirty years ago the Housatonic Railway, of Connecticut, ran trains of cars whose ends were covered and the two cars joined by flexible hoods, into the sides of which the passengers entered by doors—in fact, the modern vestibule. How Sessoms, Pullman, or any one else can get a broad patent on this device, much less successfully defend it in the courts, is a wonder. Pullman has just as much right to patent the idea of roofs over cars.

Edward B Gibbs, of St. Louis, Mo., is introducing his patented improvement on extension smoke arches. He uses a modification of the Barnes extension, such as shown in this journal for February, 1890. The improvement consists of two ¾-inch nipples, screwed into the front of the base of the exhaust stand. The jets of steam, it is claimed, prevent the cinders from igniting and kill all fire. For this reason, very large screens and a larger nozzle can be used.

Jacob Myers, for more than forty-four years a locomotive engineer, died at the age of 75, on February 8th, at Saratoga, N. Y. He commenced running in 1846, on the old Rensselaer & Saratoga road, remaining twenty-two years. Since 1868 he has run on the Adirondack road.

To find the proper size of rail for given weight of locomotive, multiply the number of tons on one driver by ten, the result being the lightest rail advisable.

Clinton B. Conger, for some years past mechanical engineer on the board of railroad commissioners of Michigan, has been appointed road foreman of engines of the C. & W. M., and the D., L. & N. railroads, a responsible position that he is eminently fitted to fill.

Those who argue that a standard sized stack for all sizes of cylinders and boilers is right, might just as well argue that a certain sized bearing was "the proper thing, regardless of the weight to be carried, or the speed attained.

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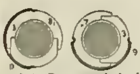

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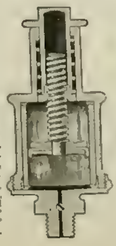

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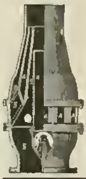

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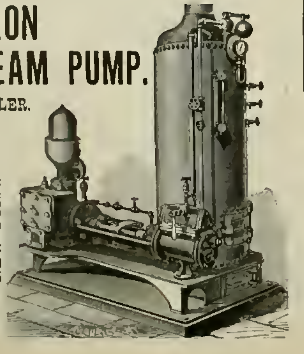

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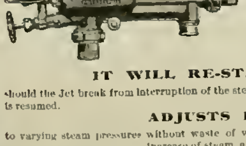

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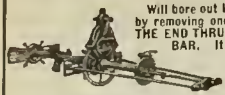

Will bore out Locomotive Cylinders IN THEIR PLACES by removing one or both heads, as desired, and piston. THE END THRUST IS ALWAYS IN EXACT LINE WITH BAR. It is fed with constant feed of cut gears.

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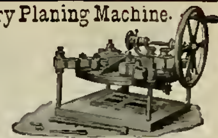

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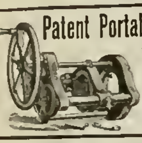

Will quickly and accurately true up Crank Pins, taking off that part that is eccentric only, leaving the fillets at the corners. It will feed either way and fit any size pin. Is built strong and powerful. Circulars with full description on application.

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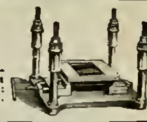

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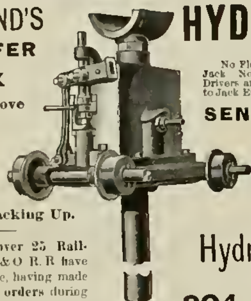

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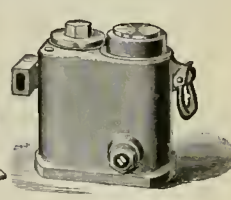

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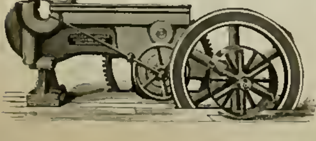
In connection with our line of Tools for above purpose, the Cut herewith shows our



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DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 4 NEW YORK, APRIL, 1891. $1.00 per Year or 10c. a copy.

It All Depends.

"I see some of the roads out of Chicago have made a cleaning out of their passenger conductors again," said the old-timer, sitting down thoughtfully on the editor's hat. "Same old story over again. I guess they won't never let up till they can get up some plan to do away with cash fares and tickets.

"Mebbe you don't remember a few years ago when the Pennsylvania put on ticket pickers and then got up a sort of a grab bag, nickel-in-the-slot-affair that was strapped to the conductor—he had to drop a ticket or a receipt for fare paid into the slot in the presence of the passenger—don't remember it, hey?

"Well I was pulling a con then, and he were a good one, but he flared up and quit—wouldn't stand it. He hadn't been running but seven or eight year, but he had saved money enough to buy a hotel, and no slouch neither, right in old Philly.

"I was in to see him not long ago and had a good talk about old times, and he sais to me, sais he

"'Frosty, old boy, they couldn't git me to wear their dam harness, they couldn't git me to go through my train with no sub-treasury attachment and an affydavy fare, like a convicted shop-lifter—not by a damsite.'

"Just here his clerk sold a cigar, and taking a quarter from the customer, jabbed a key on one of them regestering typewriter things that jumps up a card saying 'ten cents,' give the man his change, and went at something else.

"'What's that, Jim,' sais I.

"'Cash register,' sais he.

"'What fur?' sais I.

"'Why to keep them roosters from stealing my eye teeth out,' sais he.

"'Same plan as the old ticket box, hey, Jim,' sais I, laffin'.

"'Well, suthin,' sais he, kinder thinkin' like. 'But, Frosty, these hotel clerks are slick ones—steal while you're lookin' at 'em. You got to keep your eye on 'em just like a "do not" order, or they'll skin you; but you look kinder tired, old man, less have suthin'"

Makes an awful difference, Mr Editor, 'whose cretur gets hooked,' don't it?

New Forney Locomotives for the Manhattan Elevated Road.

To a railroad man familiar with the little, red engines that haul New Yorkers back and forth, a description seems much like a description of his own home; but the number of letters we constantly receive from far and near, asking about these engines, their size, weight and service, shows that the average railroader knows little or nothing about them.

MANHATTAN ELEVATED LOCOMOTIVE.

The engraving on this page was made directly from a photograph, and shows one of the latest engines put in service, and one having some new features.

The Manhattan Company now controls and operates the four lines of elevated road, on the Second, Third, Sixth and Ninth avenues, in New York City.

There are 32.40 miles of double track road, supported on iron pillars in the street, the height averaging about twenty feet above the pavement, but running higher in places. Much of the road is double lines of single track, supported on a single line of iron posts for each track, but in the latest built lines the tracks are together over the center of the street. Counting the 24.98 miles of sidings, all the trackage amounts to 89.78 miles.

The gauge is standard 4' 8½", and 70 pound steel rails are used. On each side of the rails there are 8 x 8 timbers bolted to the cross-ties to insure derailed rolling stock from going far astray.

The company has 300 locomotives and 1,100 cars, and does only a passenger business, at five cents uniform fare, the longest ride possible being from South Ferry to 155th street, a distance of a little over ten miles. The average number of passengers carried daily exceeds half a million, and has exceeded 700,000. The total yearly earnings are upward of ten million dollars. Stations are about six blocks apart, on an average, being only five in the lower part of the city, and farther apart up town.

Four and five car trains are run, during the busy hours as close as one minute and five seconds apart. A maximum speed of twenty-five miles an hour is made, the stops being so frequent as to prevent a higher average rate of speed than fifteen miles per hour.

The strength of the elevated structure limits the admissible weight for locomotives to 47,000 pounds, so that, as a rule, great pains are taken to make parts as light as is consistent with strength.

The road being built entirely over crowded streets, no water or oil can be allowed to drip, the noise of the exhaust must be chocked down, and muffled pops and escape pipes used, so that, perhaps these little engines have more pieces than a decapod.

The engines are never turned around, but run either end ahead, there being a four-wheeled truck under the tank, and no truck at the cylinder end.

The cylinder saddles are hollow and deep, and are the receptacle for some of the drip, the outlet to the cylinder cocks being piped into it. The overflow of injectors and drip cocks goes to the ash-pans, which are water-tight.

Under the cylinders and guides there are pans, as shown, to catch the drip.

The sand-boxes are located under the running board. No bells, pilots nor foot-steps are in use.

Eames' vacuum brakes are on all wheels under the engine and train, the escape of steam from the ejector being muffled by the device shown on top of the cab.

The cabs are of thin steel, lined with wood, this lining and the tank deck being all the wood used.

The exhaust pipe of these engines is large, and a long, cast-iron cone is drilled full of small holes and put into the pipe, point down. The area of the opening of the holes is equal to the port area. This device is to muffle the exhaust, and is known in road parlance as "the bug."

The boiler is of the Belpaire form, 42" diameter, with a fire-box 53¼"x31¼" and 43" deep, set on top of the frame. There are 154 tubes, 1¾" diameter and 6' 3¼" long. The grate area is 16 square feet, heating surface, 430 square feet. The drivers are 42" diameter, truck wheels, 28"; the rigid wheel base being 5', and the total wheel base 16'. The tank carries 1,600 pounds of coal and 512 gallons of water. These engines weigh 45,500 pounds empty.

The main axle journals are 5¼" in diameter and 6¼" long. The cylinders are 12" bore and 16" stroke; steam ports, 8¼"x¾"; exhaust ports, 8¼"x1¾"; travel of valve, 3¼"; throw of eccentric, 3¼", outside lap, ⅝".

The latest order of this class of engines are now building at the Baldwin works, some of the order having been delivered.

The new departure in these engines has been in lightening parts by the use of steel and wrought-iron in place of castings.

The driving wheels are forged wrought-iron, the frames are of steel, the front-end door, cylinder-head casings, etc., being of pressed steel. They still use a cast-iron stack, weighing about 600 pounds, however.

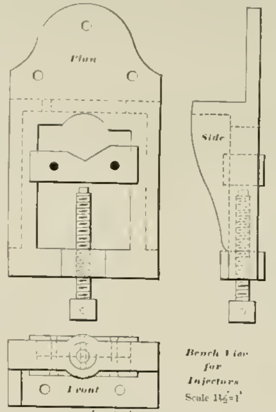
These little engines are double crewed, and average about twenty hours' work per day each, developing an average of 145 horse-power in doing their regular work.

The average consumption of fuel, which is anthracite coal, is 45.7 pounds per mile, 40.9 miles for a ton being averaged.

Crews do not always work continuously, but do not put in over eight hours' service for a day's work without extra pay. Engineers get $3.50 per day; firemen, $2. Each crew averages about 70 miles per day, and in that distance make 208 stops. Over 3,600 trains are run daily.

An Injector Vise.

The accompanying engraving represents a very handy bench vise for injector work in use in the



Boston & Albany shops at East Albany, N. Y. The body or frame of the vise is made of cast-iron; the slide or crosshead is wrought-iron, made in two pieces, and riveted together. The screw has a loose handle, like any other vise screw.

This device gives a sure grip on an injector, and has no tendency to crush the work, while it holds the instrument vertically so that the mechanic can see into the opening and get the tubes in and out to the best advantage. This feature will be appreciated by men who are working with a common vise, and giving themselves the rickets stooping over to see into the injectors.

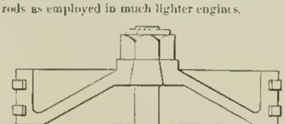
Thos. B. Purves, Jr., general foreman of this shop, says this kink saves them lots of trouble, and that they would lend the pattern to any one who wants to make a vise.

A Suggestion in Piston Design.

The more our railroad mechanics investigate the counterbalance problem, the more apparent it becomes that lighter reciprocating parts are necessary.

There is little doubt that we have been, unconsciously, perhaps, going to extremes in the matter of weight—seem to have simply increased some sizes in proportion to the total weight without regard to the work to be done or stress to be borne.

Almost all designers are doubling the size of the main pin and its connections in very heavy engines, yet they leave the same sized front end of main rods as employed in much lighter engines.



With the introduction of good cast steel, crossheads and piston heads may be made much stronger and lighter than has been possible with cast-iron.

The sketch shown herewith illustrates a form of piston in very extended use in marine practice, and tests made in England some two or three years ago showed this form of piston to be 30 per cent. lighter than a solid head, or the thick, cellular style, and having the same strength; this was for cast iron.

Two years ago the British steamship Leander had a piston of this shape put in, that was made of cast-steel; it was 78 inches in diameter and only 1¼ inch thick in the arched web.

This form of piston would have advantages for locomotive work other than in its lightness; one of these is that when placed on the forward center, and the cylinder head removed—both heads would, of course, have to conform to the shape of the piston—the piston fastening, be it nut or key, would be outside of the cylinder, where wrenches or other tools could be used upon it. Another advantage is that the piston rod packing will be in the sunken back head, and out of the way, admitting of larger packing and requiring less room at the ends of the guides, admitting of shorter guides where this would be an advantage. This piston may possibly have been used for this purpose, or have been suggested for use—we claim no originality—but it's a good thing, anyway, and will help reduce the weight of heads, and if this don't help the counterbalance, it will prevent excessive wear in the cylinder by the drag of the head.

There may be a few old engines where the arched cylinder head cover would be in the way of the front truck wheel, but they are few.

At it Again.

Under the heading, "What is an Engineer?" the *Railway Age* gives us the following:

"A quiet agitation regarding a narrower limitation to the word 'engineer' has again been started in engineering circles, with the prospect that some definite action will be taken in the matter by interested members of the profession. 'Engineer' as a term of significance is too ambiguous. It may mean a mechanical draftsman, a bridge builder, a patent counselor, a machinist in charge of a stationary engine, a locomotive operator, or followers of a dozen other pursuits.

"The words 'locomotive' and 'mechanical,' for instance, when modifying 'engineer,' respectively characterize a trade and a profession, a subordinate and his superintendent, yet both are *engineers*. One or the other should do the graceful thing, and yield.

"If the locomotive engineers are willing to take the initiative they might choose to be called 'locomoteers' or 'engine drivers,' or even 'motormeers,' the official title of electric operators. But if the professional men should be asked to give up their birthright, what characteristic term could they adopt which would embrace the tripersonality of the mechanical, civil and electrical engineer? It would at best be pseudonymic, for 'engineer' should designate the profession, and not the trade."

Engineers who run locomotives can stand to be called "runners" away ahead of "motormeers" or "locomoteers," but what is the matter with the now universally accepted term "locomotive engineer"? There are in North America more than 50,000 men entitled to that name, and perhaps a single thousand designers and master mechanics, who could be called locomotive engineers because they design or superintend the building of locomotives. Mahomet had better go to the mountain—it's easiest.

On a recent visit to a Central-Hudson shop we found machinists putting brass brackets into the exhaust ports. These brackets are screwed to the bottom of the exhaust port passage by two tap bolts, and the top comes up between the bridges and forms a cross-brace or tie between them. Several engines cracked their bridges or broke them out entirely, causing the expense of new cylinders. An unsupported bridge, only an inch wide and eighteen or twenty inches long, must spring considerably under pressures of 150 or 160, and springing means breaking.

We are in receipt of quite a number of letters from enginemen telling of cases where they have been let into blocks with other trains, and of instances where operators claimed that they could not release the signals so that they could go to danger. The block system of signals is just coming into use in this country, and it is important that its faults be understood and remedied, and that the habit of "monkeying" with the device, or in any way preventing its use rigidly for the purpose designed, must be frowned upon, and checked before faults of handling are charged against the apparatus.

The U. P. management have ordered all operators to withdraw from their order, or quit—why not tackle an organization of their size?

The First Water Grate.

There have probably been forty patents in as many years of the water grate, as used on hard coal burning locomotives, and a few that burn soft coal.

To those who think that to them or some of their friends belongs the credit for the original idea, it may be of interest to look back a few years—quite a few.

At the Museo Borbonico, at Naples, Italy, there are carefully preserved many copper and bronze tools and utensils exhumed at Pompeii, and among them a small vertical boiler of copper, this has a fire-box and smoke flue through the top, a door on the side, and *water grates* composed of small tubes of copper crossing the fire box at the bottom.

Pompeii was destroyed by an eruption of Mt. Vesuvius, A. D. 79—more than 1800 years ago.

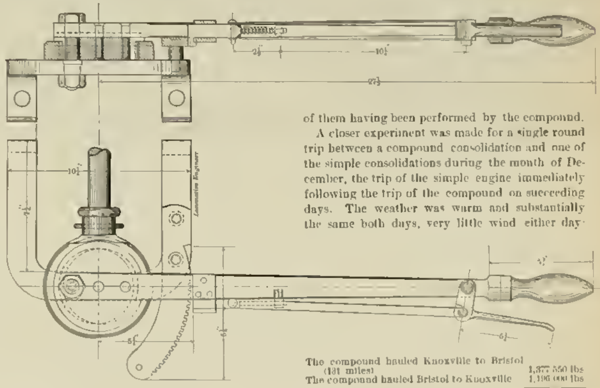
A Good Place to Work.

In Switzerland a Sunday law has been enacted applying to all railroad, steamboat and tramway companies and post-offices. Working time must not be more than twelve hours a day, even on occasions of increased traffic. Engine and train men must have at least ten hours' unbroken rest, and other employes nine hours. They must also have fifty-two days off yearly, and seventeen of these must be Sundays. No reduction in wages is to be made for such rest days. All freight traffic on Sunday is prohibited, except for live stock. The penalty for the first infraction of this law is not less than 500 francs, but a repetition means 1,000 francs, and even the willingness on the part of an employe to work on a rest day does not enter into consideration. *Ex.*

Illinois Central Throttle and Reverse Lever.

The engraving of the throttle lever and latch used on the Illinois Central, which will be found on this page, shows a departure from usual practice in the manner the throttle stem is attached to the lever.

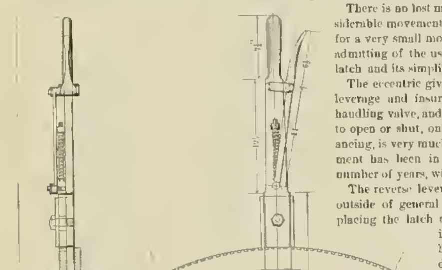
As will be seen, the throttle stem head is enlarged and has a very large hole in it, into this hole an eccentric fits, the eccentric turns on a pin that is also the pivot at end of the lever, the eccentric being fastened to the lever by a couple of rivets.



There is no lost motion in this rig, and considerable movement of the lever is required for a very small movement of the stem, thus admitting of the use of coarse notches in the latch and its simplification.

The eccentric gives the runner a powerful leverage and insures a comparatively easy handling valve, and the tendency of the valve to open or shut, on account of improper balancing, is very much reduced. This arrangement has been in use on this road for a number of years, with very gratifying results.

The reverse lever shown has two features outside of general practice. The first is in placing the latch on the side of the lever instead of in front or behind, the sector being double.



This admits of the use of six or seven teeth at once, and the latch is prevented from working loose on the lever by the long bearing permissible. If the latch is placed on the inside, or next the boiler, in those classes of engines with the boiler through the cab, there is nothing to catch the clothing of the engineman, and the notches of the sector will not get full of dirt.

A short bell crank arm is formed on the lower end of the lever, and a coiled spring, protected by a cast-iron case, is located under the deck and connected to the lever as shown. This gets the spring out of the way and prevents jerking of the lever, as the pull is all one way upon it instead of being transmitted in jerks, as is the case where the counterbalance spring is on the tumbling shaft.

In describing the Eddy engines in last month's paper, credit was given to Mr. Eddy as the first builder who placed the cylinders horizontal. The article should have read the first builder in New England. Norris built 8-wheelers with horizontal cylinders and spread trucks as early as 1850, and the "crab" locomotives built by Winans had horizontal cylinders, but vertical boilers and a geared connection to the wheels.

The first patent granted by the U. S. government bore date July 31, 1790, and was issued to Samuel Hopkins, for a process of making potash and pearlash; it was signed by George Washington. Only three patents were granted in the first year. They average 75 a day now.

The Compounds on Fuel.

In some recent tests on the E. T., V. & G., the Schenectady compound ten-wheeler showed a saving of 31.2 per cent above that of simple engines of its class. The test covered considerable time, and a number of engines were used against the compound, thus comparing it with average practice, there were 151 runs of 131 miles made, 42 of them having been performed by the compound.

A closer experiment was made for a single round trip between a compound consolidation and one of the simple consolidations during the month of December, the trip of the simple engine immediately following the trip of the compound on succeeding days. The weather was warm and substantially the same both days, very little wind either day.

The compound hauled Knoxville to Bristol (131 miles)		1,377,550 lbs
The compound hauled Bristol to Knoxville		1,196,000 lbs
Total		2,573,550 lbs.
The simple engine hauled Knoxville to Bristol		1,290,710 lbs
The simple engine hauled Bristol to Knoxville		1,128,020 lbs.
Total		2,418,730 lbs.
Work of the compound in excess of the simple, in lbs		154,820 lbs.
Work of the compound in excess of the simple, in per cent.		6.4
COAL USED.		
Compound		23,080 lbs
Simple	29,728 lbs	
6 per cent for extra work done by the compound	1,783 lbs	
Total for work equal to the compounds		31,511 lbs.
Difference between engines		8,431 lbs
Saving by the compound		26.7 per cent.
WATER USED		
Compound used ...		19,200 gal
Simple used ..	24,535 gal.	
6 per cent for excess work of compound ...	1,472 gal	
Total ...		26,007 gal
Saving by the compound ..		26.2 per cent.

The worst example of alleged steam heating of trains can be seen on the Manhattan elevated road in this city. The cars are heated fairly well, but it is almost impossible to find two steam heated cars coupled together without finding a cloud of steam around the platform, caused by leaky couplings. This system use a coupler having a trap in it, but its use is obsolete—the leaks could easily drain away four times as much water as is condensed. The steam often obscures the platform at stations, and makes it dangerous for passengers getting on or off the trains. The Manhattan Co. has 1,100 cars, and it is said that their annual repairs of steam hose alone amounts to about $7,000. On the Suburban Rapid Transit road, which is an elevated system above the Harlem River, Supt. Wetmore uses an all-iron steam connection between his cars, that costs but $38 per car, and is tight.

The heavy ten-wheelers built for New South Wales by the Baldwin works, have straight boilers, with copper fire-boxes and stays, and Vauclain's patent wrought-iron driving wheels. They have solid-ended rods, and a screw reverse gear.

The Hoosic tunnel, on the Fitchburg road, is 4¾ miles in length, and is brilliantly lighted by electricity from end to end. The locomotives burn coke. The tunnel is remarkably clear of smoke and steam. There is a large ventilating shaft near the center 1,028 feet deep.

The total number of freight cars in the United States at the end of 1889 was 1,060,164. Assuming that all those built in the railroad shops, and that over 28,000 of those built by private works have gone to fill vacant numbers, there were, at the end of 1890, 1,135,000 cars in the United States.

Locomotive Running Repairs.

By L. C. Hitchcock.

FLANGE WEAR.

Probably one of the most difficult matters with which roundhouse foremen have to contend in the line of running repairs is the wear of driver and truck wheel flanges. It is difficult in this way: where a wheel has been allowed to run to one rail more than to the other until the flange has become sharp, and a groove worn in the face of the tire, it is oftentimes a very difficult matter to get the tire to bear on the rail out of this groove.

The flange of a driving tire wears sharp owing generally to one of two causes. Either the engine is low on its springs at that point, or the drivers are not square with the engine frames, or, as it is generally expressed, they are out of tram with the engine frames In cases where only one driving tire is wearing the flange sharp (as often occurs) there is very little doubt that the engine is low on that spring, and is crowding that flange to the rail, though if the wear is noticed on either of the front drivers it may be caused by a weak engine truck spring on the side where the flange is cutting. As soon as the marks on a tire indicate that the flange is running close to the rail it should have *immediate* attention, for this is one of the jobs which it does not pay to put off until a more convenient time, for if action is taken as soon as the difficulty is discovered the proper remedy may be applied, viz.: either raising the engine at the proper points or throwing the wheels in the proper direction, and the trouble be easily overcome. But where a person is careless, and neglects to apply the remedy as soon as the need of it is discovered, it takes but a very short time for the rail to wear a groove in the tread of the tire and wear the flange sharp, and where this exists to any extent the safety of the traveling public demands that the drivers be removed and the tires be turned. And in a majority of shops this means taking the engine out of service for a week or ten days, at the least calculation, whereas, had it been taken in time, the whole difficulty might have been remedied in twenty minutes or one-half hour.

In cases of driving flange wear, the old adage, "A stitch in time saves nine," is certainly true. Cases are quite numerous where one of the back driving flanges will begin to cut. Where this occurs, the height of the engine at this point, in comparison with the height the engine stands from the other driving-boxes, should be noted. It will generally be found that the engine is low at the driver, which carries the cut flange, and removing or clipping up the driving spring will remedy the evil; but after the flange is made to run free from the rail it should be carefully watched for some time, to see that the engine does not settle at this point, for it will wear itself away faster than would be imagined if allowed to come in contact with the rail the second time.

Suppose that both drivers on one side of an eight-wheeled engine are cutting, and the distance between the bottom part of the spring saddles and top part of the engine frames are about equal on each side, it would be safe to conclude that the main axles are not square with the frames. The first thing to ascertain in a case of this kind is whether the center casting, which rests in the engine truck center casting, is in an exact central position between the engine frames. In case it is not centrally located it should be changed to that position, for when it is out of center it often causes both the driving flanges and engine truck flanges to wear sharp. And right here let me say that I am not an advocate of what is commonly called a swing beam engine truck, that is, one having a movable center casting, for my observation leads me to believe that engines having the swing beam trucks wear the flanges of both the engine truck wheels and forward drivers more than do engines having the rigid trucks, when the engine is kept away from the side bearings of same.

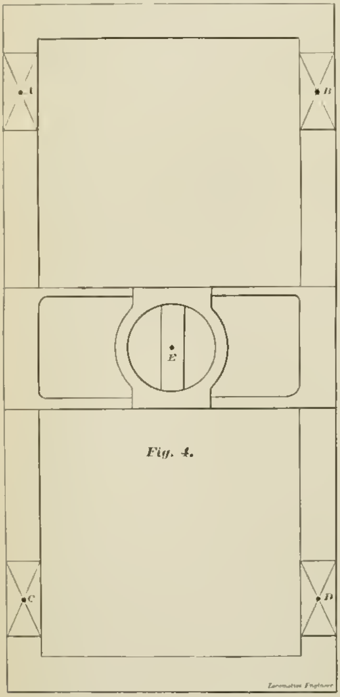


Fig. 4.

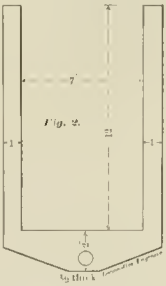


Fig. 2.

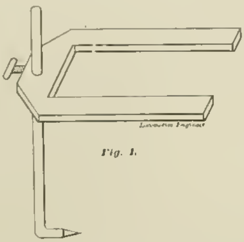


Fig. 1.

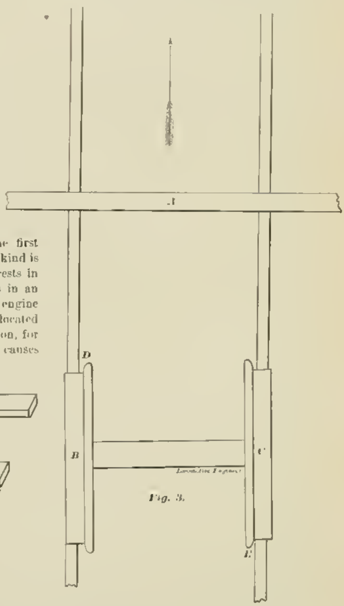


Fig. 3.

Now to return to the case in hand. Should the center casting be centrally located the trouble is surely not there, and to ascertain if it is caused by the driving axles being out of square with the engine frames, first set up the wedges until the driving-boxes will just move between the shoe and wedge, then clamp a straight edge about eight feet long flatwise on top of the engine frames, just forward of the tumbling shaft boxes, and perfectly square with the frame on each side Now see that the distances from the main centers to the top of the engine frames are equal on each side of the engine. To ascertain this, use a small tool shown in Fig. 1, made of ¼" steel. (See Fig. 2 for dimensions.) Place the driver so that a spoke will be in a perpendicular position, and directly in line with the center of the spring saddle, then pass a leg of the tool mentioned on each side of the spoke and saddle. Hold the flat side of the legs firmly on top of the frame and set the pointer to the main center; now remove the gauge without disturbing the pointer and try the other side. In case the two distances are not the same, raise the low side of the engine until they are the same, then prick-punch the back edge of the straight-edge you have clamped forward of the tumbling shaft boxes an equal distance outside of each frame, and from these punch marks tram to the center of the forward driving wheels, and I think that you will find the center of the driving wheel having the cut flange farther from the straight-edge than that of the opposite driver. Perchance this can more readily be understood by reference to Fig. 3, representing in an exaggerated manner the position of a pair of drivers under the conditions mentioned. The forward part of the engine being indicated by the dart, the straight-edge *A* clamped to the frames Now if wheel *B* is farther from the straight-edge, when placed as described, than is wheel *C*, the flange of wheel *B* will be crowded to the rail at point *D* when the engine is moving forward, and the flange of wheel *C* will hug the rail at point *E* when the engine is running backward; but as engines usually run forward more than backward the left drivers in the case under consideration would show the greater amount of flange wear. To remedy the evil, either the right drivers must be thrown back, or the left wheel forward, to bring a line through their centers parallel with the straight edge, and a good way to proceed is to either remove liner from the left shoe or to plane from the face of it about two-thirds the amount that the wheel center shows out with the straight-edge. Then add to the wedge the same amount of liner that was either planed from the face of the shoe or was taken from it by the removal of liner Now if the distance between the forward and back drivers were the same on both sides of the engine, this same operation must be performed with the left back shoe and wedge; this will bring the drivers again in tram, and both pairs will be square with the engine frames, and I think would give no more trouble.

Should the engine truck wheel flanges begin cutting, see that the engine truck springs hold the forward part of the engine level, and that the male center casting is centrally located between the engine frames, as previously mentioned. If so, take off the pilot and run the truck out. If it is a truck with a swinging center casting, place a piece of thin board tightly within the casting, and on this board get the exact center of the casting. Now drop the binders and jack up the frame until the bottom of the jaws is nearly to the top of the boxes. Then scribe on top of the frame the face line of each jaw. This may be done by the use of three short straight-edges. Next place the center casting in an exact central position between the ends and sides of the truck frame. Now, referring to Fig. 4, see that the distances from the points A to E, B to E, C to E and D to E are equal. If they are not equal it shows that either the jaws are not bolted to the frame in the proper positions, or that the truck frame is not square, and one or both pairs of truck wheels are not square with the frame, producing the same evil which exists with the pair of drivers represented by Fig. 3, and means should be taken to make the distances from central point E to the center of the truck-boxes equal. After this is accomplished ask the master mechanic to allow you to block the casting in this position, the results obtained from thus blocking it would, I believe, be very gratifying to you both.

If the trucks under tenders are squared in the manner just described, and the tenders are kept level on their springs, and away from the side bearings, I think that there will be very little trouble caused by the wheels having sharp flanges.

wipers as "the ingine wid two chimblys," and Uncle Amos was boring the snout of a long can toward the eccentrics, said snout having some nine particular crooks to miss everything. Mike looked at Uncle Amos, set down his grip and walked around the engine on a tour of inspection. When he got around Uncle Amos withdrew the spout of his can like you would take a corkscrew out of a cork, and said.

"Be you the man sent down to run her whilst I'm off?" "Yes," said Lillis, "but I'll tell you what I'll do, old man, you just stay with the pesky varmint and I'll take the ten days!" And he went home on the next train.

We must know the names and addresses of writers, but not for publication necessarily. Letters signed "Old Timer," "Kicker," or "Young Runner" alone are used to kindle fires. Always write on one side of the paper.

An Early Passenger Coach.

The accompanying engraving represents a form of car once used for passenger and freight service on the South Carolina road.

This road was one of the first in this country, being the first to use an American built engine.

The car here shown was the invention of one George S Hacker, an inventor of more or less merit, to whom the invention of the fifth wheel of common wagons and carriages is accredited. The patent on this car was number 1937, dated January 21st, 1841; our engraving was made from a tracing made from the original drawing on the 9th of February by Chief Draftsman W. J. Wilcox, of the S. C. road.

Tubular cars are advocated as something new at frequent intervals, but this car seems to have been in actual use many years ago, and there are a great many people still living in the South who have ridden in these old hooped tubes.

mare's nest to paralyze its opponents. Instead of taking anything like average American practice, they cite the two Erie locomotives tried against the Strong, by a Strong employe, making out an advertising and glorifying report to boom the double barreled boiler and gridiron valve machine designed by Mr. Strong.

Mr. Dean made out a large percentage of saving for the Strong, and, in order to do this, Erie men allege, made the performance of the other engines none too good. The officers of the Erie road say nothing for publication on the subject, but do not hesitate to say in private that Mr. Dean's report is not fair to their engines at all.

Less than a year ago, Mr. Ross Kells, Supt. of M. P. of the Erie, reported to the American Railway Master Mechanics Association's committee on valve gears as follows:

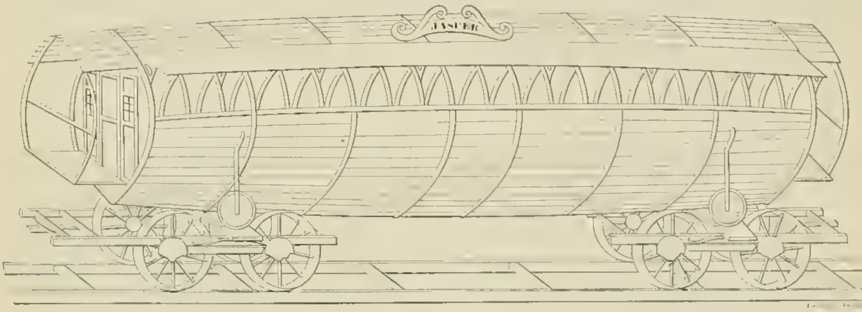
"We have only made one test of a locomotive equipped with a valve motion, other than the link, and that test was to determine which of the two designs was the most economical on the basis of coal consumed per ton per hundred miles. We found on this test that our regular link motion locomotives were fully as economical on coal, and much more economical on maintenance of valve gear."

This refers to the test by Mr. Dean.

The Erie engine compared to the Strong was a hard-coal burner, with a fire-box 11 feet 6 inches long. This engine was tried against the Strong with hard coal. The Strong could not burn this fuel well, and so the other engine was fired with soft coal. In practice, when one of these engines is used as a soft-coal burner, about one-third of the grates are bricked over, the engine burning a better fire, and steaming freer than when the full length of the box is used. Again, the Erie road is what may be termed a "coal road." Fuel is cheap, and little attention is paid to economizing it.

Yet our English friends have hunted long and diligently for an "awful example" to hold up in comparison with their best practice.

Comparisons should be fair on both sides.



Preferred the Disease to the Cure.

A long time ago the Denver & Rio Grande road owned an old English engine of the Fairlie make. She had four cylinders, eight connected wheels, no truck or tender; there were two sets of flues, a fire-box in the center of the boiler, and a stack on each end. The fire-doors were on the side of the boiler, the coal on top, and the water in side tanks. In the cab there were two throttles, and a lot of other dinguses that it wasn't safe to touch unless you knew just what would happen afterward.

Every man who had run her had added something—none carried anything away. The running gear underneath was sort of a scrambled scrap heap, and all new men had a chart to oil by.

The old Fairlie served a purpose in her day in appeasing a lot of English stockholders, but soon started down the scale from passenger to freight, construction, and the scrap heap. At the construction stage of the game she was in charge of an old-timer, Amos McKenna by name, who managed to get along with her pretty well—especially laying on sidings.

But one day Uncle Amos and the Fairlie had a chill at the same time, and a regular train found them on the main line with no flag out, and reported it; the division superintendent ordered the crew suspended for ten days.

Mike Lillis' engine was in the shop, and Mike was losing time, so he was glad when he got orders to loaf on construction for ten days—Mike hadn't seen the Fairlie then.

When Mike got off at the little desert station, he saw for the first time the locomotive known to the

The Webb Compound Again in Harness.

The Webb compound locomotive is in express service between New York and Philadelphia again, and doing remarkably good work. She made the ninety miles the other day in two hours and four minutes, hauling eight heavy coaches and making seven stops.

We recently saw a letter from a prominent Pennsylvania official, in which he said: "I am not at liberty to give exact figures as to the saving of coal shown by the Webb engine over our regular passenger locomotives, but will say that it has been considerably over 25 per cent."

Hunting for "Awful Examples."

For some time past there has been a triangular discussion going on between two American and one English engineering paper as to the relative value of the locomotives common to the two countries. When arguments ran low, each side commenced to promise some showing of facts and figures after a time, to prove the ground taken in each case.

The Engineer, of London, has just opened up its

Mr. Phillip Hoffecker, master mechanic of the Lehigh Valley road at Weatherly, Pa., died on February 19th. Mr. Hoffecker was one of the oldest master mechanics in this country, and was employed in building the Beaver Meadow road before it owned any rolling stock. He became M. M. of this line, and remained in the place after the L. V. got the road. He was the originator of the 12-wheeled locomotive—eight wheels connected and four-wheeled truck. He paid particular attention to his foundry, and driving wheel and cylinder castings turned out were so smooth and clean cut it seemed a sacrilege to put a tool into them.

The Belt Railway of Chicago have in use a section of track south of Sixty ninth street that is laid with the Standard steel tie. This track has been down fifteen months, during which time 37,500 trains passed over it without perceptible wear or distortion of the track. These ties weigh but eighty two pounds each.

In all countries of Europe, excepting Spain, there are laws against the use of cast iron wheels under cars or locomotives in passenger service.

Varnish.

Varnish is varnish, and that's about all you can tell about it, except what the maker says and the price he asks—and sometimes makers will overdo both these.

There is no short, easy test for varnish that is reliable. Those that are in use are a good deal like Ikey Ichabod's plan for telling a singer from a female canary bird. He said: "Put sugar on a wet cracker and stick it into the cage, and if a *she* comes up and pecks it, why it's a *she*; but if a *he* comes up and pecks it, why it's a singer, dontcher see?"

The only way to test varnish is to use it. On the C., M. & St. P. road, they varnished some 200 cars some time ago with two kinds of varnish, half one, half another make. This is a good test, but sends the cars out on a big system where they are not often seen by those who are conducting the experiments, and as one end of a car got shabby first, many had to be taken in early for re-varnishing.

Mr. Wetmore, of the Suburban road in this city, painted several boards just as he does his cars, then varnished them with different makes of varnish, and hung them out to the weather; the results were surprising. If we should tell just what they were, there would be one varnish maker pleased, and about four would say we lied. The best varnish was the highest priced—like anything else.

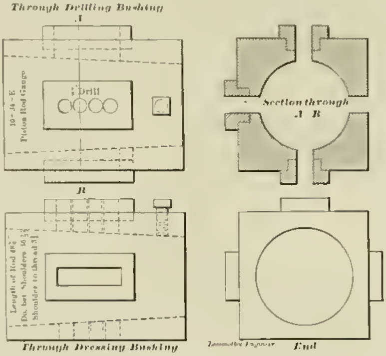
At roundhouses where there is no stationary boiler, an efficient fire extinguishing apparatus can be devised to attach to a locomotive injector. A steam ejector with hose attached, located between two stalls, and having an easily attached or detachable connection to the blower, or an independent steam cock, is better and easier taken care of. All yard engines should be equipped with "squirts" for fire purposes.

Piston Rod Gauge.

The piston rod gauge shown herewith was designed by Thomas B. Purves, Jr., general foreman of the B. & A. shops at East Albany, N. Y., and is a time saving device that prevents lots of guesswork and measuring in the finishing of piston rod ends, insuring interchangeability when rods are kept in stock. The gauge is made of cast-steel bored out the correct taper to fit the rod when finished. There is also a taper plug, not shown, that just fits this hole, that is used as a gauge to bore out crossheads and piston heads.

Once the taper on end of rod fits the gauge, the latter is fastened to the rod by the set-screw shown, and the keyway is then cut out, first by drilling through the guide holes shown, and then by chipping and filing. The guide pieces are hardened steel, pressed into place, and, as will be seen, admit of dressing out the keyway perfectly central on the rod without any laying out at all.

The gauge is plainly marked with the dimensions of rod throughout, and, of course, a separate gauge is used for each size of rod, the gauge in this case being for the Baldwin consolidations that pull freight over the B. & A.

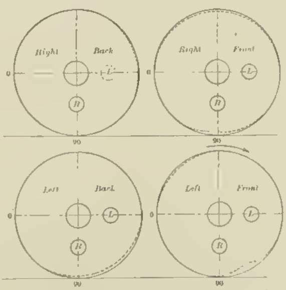


Device to Measure Uneven Wear of Tire.

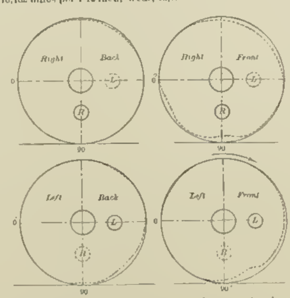
W. H. Lewis, master mechanic of the Chicago, Burlington & Northern, has designed an ingenious device for showing the wear of driving wheel tire. He recently described it before the Western Railway Club as follows:

"I have given the subject of counterbalancing locomotives some considerable study, and I feel a great interest in the matter. About a year ago, when this subject was before the club, I noticed a reluctance on the part of the members to enter into the discussion of the flattening of tires which took place in certain localities, particularly where they had a sandy road bed. I have made an apparatus by which I can take a perfect picture of the flat spots and their location. The instrument consists of a revolving disk attached to the tool-post of a driving wheel lathe, and geared to the head block of the lathe, so that it makes the same revolutions as the face-plate. The pencil bar attachment is first set at the inside of the tire, with the point of the pencil at zero, or the center mark on the paper. Then by moving the pencil bar to the tread of the tire, and allowing the lathe to make one revolution, it describes a circle the radius of which represents the thickness of the tire, and at the same time locates accurately the position and depth of the flat spots."

The accompanying diagrams are reproduced from full-sized ones taken by this apparatus, there



Engine No. 8.—Passenger mileage between turnings, 75,152 miles per 1-16 inch; wear, 18,788



Engine No. 11.—Passenger mileage between turnings, 46,413

being also a true circle drawn to show the size of the flat spots more clearly. This true circle, together with the axle and crank-pin circles, are drawn by hand.

These tire pictures were taken from 8-wheeled passenger locomotives, having cylinders 18x24, with 54,500 pounds on the drivers. We reproduce the cuts from the *Railway Review*.

Correspondence

Who Invented the Cast-iron Brake Shoe?

Editor The Locomotive Engineer:

You asked in a recent number, who invented the common cast-iron brake shoe. The cast-iron brake shoe was patented by Stephen Morse, Feb. 23d, 1858.

WILSON EDDY.

Springfield, Mass.

Burning of Oil in Chests and Cylinders.

Editor The Locomotive Engineer:

I am firing on a fast passenger run, and I notice that after oiling the valves there is a strong smell of burning oil, just after the lever is pulled up. I know there is a vacuum in the cylinders, which increases as the lever is pulled up, and which draws the hot air and gases through the stack into them. And I think that if the throttle was opened just enough to fill the cylinders with steam before the lever was pulled back, that more good would be got from the oils. Please give your opinion.

Portland, Me. FIREMAN.

[Burning cylinder oil generally indicates a poor quality of oil, or hot rods or pistons caused by cutting. The partial vacuum in the chest is not increased by hooking up; compression in one end of the cylinder will lift the valve off its seat, and equalize matters; the mere hooking up of the lever will generally throw oil and vapor out of the oil cups, indicating a pressure. Opening the throttle before hooking up would make the lever handle harder, and the first steam admitted will wipe off all the surplus oil, any way.]

Air-pumps with Lung Trouble.

Editor The Locomotive Engineer:

I was called out in the yard recently to see what was the matter with an air-pump. It would pump 20 or 30 pounds of air, keep to work, slowly, but would not increase the pressure. I put the brake valve at full release, and opened the cock back of tender, this relieved the drum of pressure and gave the pump an easier job, but it did not run faster at all, which as good as said that it could not get rid of the air it pumped, or was not getting steam enough to run it, the latter not being probable at all. I took off the air-pipe connection to the air cylinder, and the instant the nut was slackened the pump commenced to run fast. The pipe was almost stopped up by oil and dirt; this was burnt out, and the pump was cured. At another time an engineer called me to see his pump, it would not make more than a couple of strokes, when it would stop. By opening the waste cock the pump would make a stroke or two slowly, steam blowing out of the waste cock hard; this told me that something was wrong with the exhaust, the pump could not get rid of her steam. Slacking off the nut of exhaust pipe caused the pump to race. The end of the pipe had become clogged with cinders in the front end.

WM. LANSING.

Cedar Rapids, Iowa.

Low Water Alarm for Locomotive Boilers.

Editor The Locomotive Engineer:

Almost everywhere you go you will find some sort of device in use on stationary boilers to give alarm in case of low water.

Why would not something of the kind be a good thing for locomotives?

I am sure that the locomotive engineer has his attention called away from the water supply more than his brother in the basement.

LAYMAN.

Boston, Mass.

[Once in a while the locomotive engineer gets water down too low for comfort or safety, but the introduction of some device to cause an alarm when they get water too *high* would be worth more money to the railroads.]

A Kicker Against the Eddy Engines.

Editor The Locomotive Engineer:

I would like to have you give a reader of your paper a few points about those "Eddy clocks" which you try to enthuse over. Why is it necessary to allow anything for expansion at *front* ends of boiler and not at the *back?* Is it because the smoke-box is hotter than the fire-box?

Why do engines designed for freight service require different size openings than for express? One would think that steam should be used to the best possible advantage in all engines. Would it not have been better to have done away with the usual steam pipes and used the oil pipes to have furnished steam for the cylinders? They could have been made a little larger and saved putting pipes inside of boiler, and that would have saved the "screw patch" to get into the boiler.

Am glad to know that all that is required to make a sand box perfect is to shape it as ugly as possible, which makes the sand so homesick while in it that it waits very impatiently to get a chance to get out. Who can blame it? It is possible that such good results are obtained from these engines on account of the two cannons (one with the bell muzzle) on top of boiler. If so, what part of the work do they perform in getting trains over the road? Why is an 8" port right for a freight engine and 12" for passenger, regardless of size cylinder they are to have? Why do you claim that there is so much saving in having the fire-box 4" wider than ordinary engines? and if that 4" does so much good, why does not the "Wooten fire-box," which is 8 feet wide, show some saving in proportion to its width? If it would, you would be able to start a coal yard from the savings of such a fire-box.

Why have the B. & A. R. R. Co. quit making these wonderful engines? Hope you will not think it too much trouble to explain these things to anxious minds. As soon as these things are all made plain, there will not be any more use for the *Indicator*. *Hand-books of the Locomotive* will be dead stock. Experts will be looking for jobs in hydraulics, and all the rest of us who have spent much of our lives trying to improve the locomotive will know that our time has been worse than wasted, as it has assisted many to waste much time and money for their employers. Why were not these wonderful engines known to the railroad world before this time? "INDICATOR."

Boston, Mass.

[We will leave our correspondent to the mercy of those who know all about the service rendered by the engines mentioned, who can, and no doubt will, tell him what he wants to know.]

That Leak Through the Pressure-retaining Valve.

Editor The Locomotive Engineer:

I think your answer to B. & O., in the March issue, went about a "millimeter" shy of explaining the cause of the trouble complained of.

I had about six or eight months' experience once in "switching air ahead" myself—or, in other words, in handling an air-brake engine in freight service, where only a part of the cars were equipped with air-brakes—and I think we had more trouble from leaks through the exhaust opening, and through the bleeding valves, than from any other source. This leak through the exhaust port was almost always attended with application of the brake, more or less severe on the car affected, and, through a sort of a dual regard for the life of the fireman and the coal record, I used to "cut the cars out."

One day I struck that prince of all educators in railroading—the "way freight"—and, armed with an engineer's "best friend"—the monkey-wrench—I proceeded to investigate one of these refractory subjects, while the boys were unloading freight.

I took off the triple valve and took it apart, and found the spring that holds the emergency valve up to its seat jammed in such a manner that the valve would not seat, and the air, of course, opened the check valve below, and admitted air from the train pipe direct to the brake cylinder, and, the slide valve being in release position, it would, of course, escape through the exhaust.

With only a few air cars in the train, and a good pump, and a pretty free flow of air through the emergency valve, you can see that the brake would set with nearly full train pipe pressure. I also found inside of the valve casing quite a quantity of sand, which, as the strainer was in place and in good condition, I concluded must have come off the inside of the valve casing casting.

So I opine that the trouble is very often with the triple *valve* and not with the *men*.

Chillicothe, Mo. A. H. TUCKER.

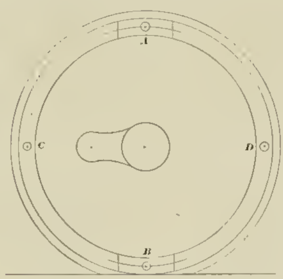
[In a great deal of personal tribulations of this kind we have always found the trouble in the brakesmen trying to "stop the leak." Our first correspondent did not state that the escape of air was continuous. He has since stated the trouble more fully, and we have told him to look just where Brother Tucker puts his finger. We want to say right here that this idea of looking up and locating the true cause of trouble is highly commendable, and should be more widely followed.]

Taking Dead Centers—The Trouble with Measuring One Side Only.

Editor The Locomotive Engineer:

In your March, 1891, issue, Bro. E. A. Campbell says that I can save time and trouble while setting locomotive slide valves by using centers on one side and quarter on the other. I do not clearly understand him; had he said use centers on one side, and quarter for the other, I would have concluded that he meant to equally divide the space on the tire between the two center marks.

To illustrate, let *A* and *B* represent the dead center marks obtained, as described by me in your February, 1891, issue, then the points *C* and *D* would be the quarter marks, and when the valve tram would reach from the mark on the wheel



cover to one of these quarter marks, the opposite side of the engine would be on the center. Is this what Bro. Campbell meant? If not, will he please explain in detail what he refers to in your March issue, for if there is anything new, I wish to "catch on," and have all readers of THE LOCOMOTIVE ENGINEER do likewise. I have worked in the manner just described, but never found much advantage over taking centers on both sides the same, as you have to walk from side to side of the engine in either case, and I thought that the method of quartering the wheel would not be so readily understood by novices.

Minneapolis, Minn. L. C. HITCHCOCK.

Why the Emergency Valve Opened for a Service Stop.

Editor The Locomotive Engineer:

I took a ride on an accommodation train one day lately, and found out something about the automatic brake that I wanted to know.

The train consisted of one coach, one baggage car, five box cars, and ten street stable cars. The stable cars had the quick-acting brake, and every time the engineer made a stop everything stood on end at the rear; this was not slack, but the emergency stop.

After two bad stops I went over to the engine and asked the engineer what was the matter. He said he reduced the air very carefully, and yet it seemed as though the quick-action valves worked every time he tried to stop.

We had some time to wait for other trains, so I arranged with him to set the brakes when I gave him a signal. He was to reduce the pressure but five pounds on the gauge—he had the new equalizing discharge valve—and then put the valve on lap.

I went back and turned a train pipe cock between the fifth and sixth car, and then gave him the signal. When he reduced the pressure the brakes went to work just as they should, proving that the trouble was further back. I cut the back cars in again, waited till the pressure equalized, and signaled for brakes. At once the quick-action opened with a vengeance, and the brakes applied full. I was not satisfied, and went to the engine and applied the air myself very slowly for service stop, reducing but five pounds, but the quick-action went to work just as before.

I then watched each brake separately, and found no difference, except in the one on the sixth car; this brake did not move out as soon as the others did for service stop, but waited a second or two, and then went on full, the others following it. this I figured was caused by the sudden reduction of pressure caused by the opening of one quick-action valve.

We cut the air out from the auxiliary of this car, and removed triple valve, and found the trouble. The small brass pin that goes from the piston rod to the little graduating valve, to pull it open, had broken off, and did not unseat for the service stop reduction, so when the reduction was made the piston moved out until the stop on its rod came to the large slide and delayed there until the difference between the train pipe pressure and the pressure in the auxiliary was great enough to move the large valve, this threw open the quick-action valve, and the reduction in train pipe, caused by it, threw on the others as described.

I have known of similar trouble with brakes, and engineers complaining that the emergency goes on for a service stop, but they are generally charged with bad handling of the valve. I have little doubt that a similar derangement of one valve in many has caused a great deal of annoyance and trouble. I have never seen a similar case spoken of in print, and am anxious to help my brother air-brake doctors to locate diseases by the symptoms.

Cedar Rapids, Iowa. WM. LANSING.

Those Pressure-retaining Valves.

Editor The Locomotive Engineer:

Your answer to Question 25, in last month's issue, on the cause of escape of pressure from pressure-retaining valve, does not cover the case for those here.

I recently found two from which pressure escaped all the time so bad that the pump could not supply the leak. E. TAYLOR.

Baltimore, Md.

[The trouble is in the triple valve, then; if it did not let the air to the exhaust passage it could not escape at the retaining valve; some valve leaks, is off its seat, or broken—probably the quick action valve.]

Counterbalancing for High Speeds—A Letter from the Inventor of the Shaw Locomotive—A New Design Under Way.

Editor The Locomotive Engineer:

I was much pleased in reading, in your last issue, an account of some experiments being made to determine the cause of uneven wear in driving wheel tires, by J. N. Barr, superintendent of motive power of the C., M. & St. P. road, and I sincerely hope that he may continue his experiments until he has fully determined the cause by exhaustive trials, and settle it beyond question.

I have been skirmishing along that line for some time. Seventeen years ago I took this subject up, and did not have far to look to discover what, to my mind, was the difficulty, viz., the counter weights.

And up to this time no one has been able to find any other reasonable cause, and never will. The outcome of my investigation was the introduction of the now well-known Shaw locomotive, in which there is no evidence of imperceptible slip or uneven wear of tires.

There has been a great deal of ignorance displayed and nonsense written on this subject, but no careful investigator, who has made any real experiments, has ever arrived at any other conclusion than that the trouble was caused by the counterweights. And there is but one remedy, and that is to take them out, they do no real good at high speeds, and cause a terrible misunderstanding among the main members of the machine.

A locomotive having a speed of translation of say fifty miles per hour at the center of rotation, its counterweights have a speed of about one hundred miles per hour at the top of the wheel. Now if there is no slip (as some suppose), then it must come to rest at its instantaneous axis—the point in contact with the rail—during one half revolution of the driving wheel, which is impossible according to the laws of motion, therefore we have that imperceptible slip going on (under high velocity) continuously.

It has been said by one of our leading railway journals that the Shaw locomotive is too complicated for general use, and it is not likely that the engineering world will ever go so far looking for a remedy for unbalanced mechanism. I do not know what they mean by that, without they expect to do it with the ordinary counterweight, which none of us will live long enough to do or see done.

I know it is difficult to convince railroad men that there is anything better than what we have now in use, especially those who say they can balance their locomotives with the valve gear—and that is what a leading railroad officer recently declared.

The objection to the original four-cylinder Shaw engine was complication, but that has been overcome by the use of one cylinder on a side, as in ordinary locomotives. The deadly paralleled rod is avoided as well by use of a different means of coupling the wheels.

This engine will also have a new valve gear, which I will soon explain to you, for the benefit of those who see untold virtues in the shifting link.

I hope soon to construct a locomotive on my latest plan, and have no doubt but that I can satisfy Brother Le Van by taking an express train from New York to Philadelphia, "ninety miles in ninety minutes." There is nothing unreasonable in his plan, and I am firmly convinced that the time will be made regularly at no distant day.

HENRY F. SHAW,
West Roxbury, Mass. Mechanical Engineer

The First Locomotives with Horizontal Cylinders.

Editor The Locomotive Engineer:

Latterly I have seen accounts of two or three different engines having the *first* horizontal cylinders ever built in this country. Allow me to add a little history to the list. In June, 1847, I was braking on the Reading Railroad, between Port Richmond and Palo Alto, Schuylkill County. In the roundhouse at Schuylkill Haven, there was, at that time, lying an engine built by Ross Winans, of Baltimore, and named Baltimore, and she had horizontal cylinders. I cannot tell you when she was built, but she had run on the Reading road before my advent there. In the following December I was in Baltimore and saw Ross Winans' spur wheel engines at work in Mount Clare yard, for the B. & O. R. R., that looked as though they had been at work for a year or two, and they had also horizontal cylinders.

E. J. RAUCH
New York City.

Relyea's Puzzle and a Kink.

Editor The Locomotive Engineer:

I see in the March number that Mr. Relyea kept his promise, and I will give the readers a few of the defects that I have found that caused the air pump to blow as he describes. First, there is a steam port through the head, and bushing to reversing valve, that in a well-fitting bushing, but only has $\frac{1}{16}$" metal to hold the steam pressure, and this often blows through at this point.

I have, for the past three years, been increasing the metal at this place by putting a ring on the bottom of bushing.

Also, a loose reversing valve stem will cause a pump to blow on the up stroke of piston; also a short reversing valve bushing, or cap, not making a perfect joint at top of the bushing.

I will give the air pump men a plan of a more convenient way of handling the pump in the shop than I have seen anywhere in my travels. I have a portable bench, 20" high, with two brackets made of $\frac{1}{2}$"x3" iron, 8' high, bolted to bench, 12" apart. To these I bolt the pump to be repaired, and I find it quite an improvement over a loose block on the floor, as is mostly used.

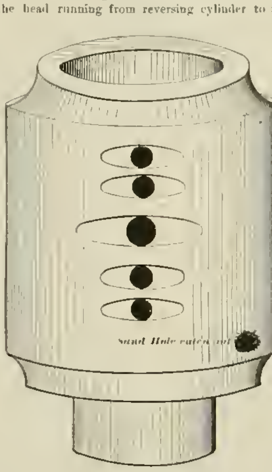
C. E. N.
Mandan, N. D.

Relyea's Air-pump Puzzle.

Editor The Locomotive Engineer:

I want to take a whack at Relyea's pump-head problem. I think the blow on the upward stroke was caused by a loose reversing cylinder; they are made tapering for a short distance from the top, and the head is also made tapering in the chamber where the cylinder is placed, so that it will conform to the taper of the cylinder, and form a tight joint. But if the cylinder is too small in diameter it will strike on the shoulder at the bottom before it strikes on the taper. And as there is an exhaust steam port running through the side of the cylinder, communicating with the reversing valve bush, for allowing the steam to exhaust from the top of the reversing piston while the pump is making its upward stroke, the reversing valve should and does cover this port at one end; but if the reversing cylinder was loose steam would leak through from the top of reversing piston into a groove that is cut alongside of the reversing cylinder near its bottom, and cause the blow on the up stroke. During the down stroke this port in reversing cylinder is closed by reversing piston.

One other thing that would cause a blow: In the head running from reversing cylinder to re-



versing valve chamber are three ports, nearly horizontal, the top one for live steam to top of reversing piston, the other two exhaust ports. These are divided by partitions of iron; if through a flaw or sand-hole these ports should become connected with the lower exhaust port, it would cause the blow.

F. B. ARMSTRONG.
Camden, N. J.

The Answer.

Editor The Locomotive Engineer:

I thought the best way to explain my last air-pump "conundrum" would be to send you a drawing of the reversing valve bush, showing how it was cut with steam, causing it to blow through into the cylinder.

W. F. RELYEA.
Syracuse, N. Y.

Air-brake Trouble—Red-hot Pipes—The Engineer's Valve.

Editor The Locomotive Engineer:

I would like to ask Mr. Relyea, or some other "air-brake" man, if he has ever seen the discharge pipes from the air-pump to main air reservoir get red-hot, and what, in his opinion, is the chief cause of it?

Engineers have them get hot sometimes, and cool off again, without anything being done to pipe or pump.

I would like to ask the name of the inventor of the engineer's brake and equalizing and discharge valve. While I am talking about this valve, I would say I can seldom find any one who will say anything in its favor, though I know of one person who says that it is the best thing that was ever put on an engine. I think the great trouble lies in the engineers not fully understanding the principle of it. Engineers, almost without exception, are running them in release position, thereby having no excess. Some say, if they run them in running position the brakes leak on—some say, because all cars in their trains have not got the quick-action triple valves on. Now the last reason given is a poor one: for, no matter what kind of a triple valve is used, the excess pressure is what releases the automatic brake, and if the old-style triple valve is used, they need the twenty pounds excess more, I should say, than where the quick action valve is used. This is my view of it. Am I right?

F. B. A.
Camden, N. J.

[There is little doubt that the greatest trouble with the engineer's brake and equalizing and discharge valve comes from the runners not being posted on its principles and operation. The claim that brakes leak on when running in proper position (running position) is a mistake, unless there is an escape of air from the train pipe, that brakes sometimes "leak off" when valve is "on lap," we do not doubt. Much nicer and more accurate braking can be done on long trains with the equalizing valve than can be done by either old style. The excess pressure feature is a very useful adjunct, especially where drum capacity is small, and where cars are picked up on the road. There are few engines that pull long trains of 20 to 50 cars, that have drum capacity enough. A large volume of air is not affected so much by the addition of cars, or the use of the brakes for service stops. With a good pump and reliable governor on a locomotive having two drums, the excess pressure valve loses some of its virtue, and can be got rid of easily, but with small drums it is in the nature of a necessity.]

Shut-off Valves in Steam Pipes.

Editor The Locomotive Engineer:

I have often wondered what was the reason valves were not put in convey or steam pipes to the steam chests. It seems to me that by the valves standing open, and steam passing through, the seats would not melt, and the stem could be packed with asbestos packing, fire could not burn it out, and the stem could protrude through the smoke arch, so it would be handy to shut off. In case you would break a chest, you would not have to break the joint and put in a thin piece of iron, and in case you would have to disconnect, you need not clamp the valve stem or block the crosshead so carefully. Could these valves be put in or not, and if they can, why are they not put in?

Wellston, Ohio. MERRY DEVINE.

[We are afraid the introduction of shut-off valves in steam pipes would be like every man carrying an instrument in the pocket to observe eclipses with—hardly enough use for it to pay, and a piece of smoked glass answers so well when the eclipse comes. It would be impossible to prevent the flow of steam from cutting out seats, and "the game would not pay for the candle." It is very seldom that a break occurs where it is not possible to block the inlet passages at the valve seat. Some shut-off scheme probably could be used if it would pay, there is no need of it at present.]

The Modest Man and Other Things of Interest on the B. & A.

Editor The Locomotive Engineer:

That superintendent who gave his men proper credit for good work done need not have been so modest, and I want him known, so give him away. His name is W. R. Robeson, Jr., and he holds forth at East Albany, N. Y., on the Boston & Albany.

We are all pleased over the show up you gave the "Eddy clocks"—they were better than they looked. On the Boston division the boys call 'em the "corn-poppers," and the wrought iron driving spring box between the wheels has long been known as the "hog trough."

We are breaking driving springs on a class of engines that have a push down driver brake; some think the brake helps break them, as they usually let go while it is on.

W. E. ANDROS.
Albany, N. Y.

The Electric Sand-box.

Editor The Locomotive Engineer:

A new wrinkle for these parts has recently appeared from the B. & O. shops in this city, viz., the substitution of electricity for sand, with which is combined a plan to increase the power of the engine to which it is applied, by one-third. The locomotive on which this experiment is being tried is an 8-wheel passenger, of the long fire-box type, built at the company's shops in 1886. The dynamo for generating the electricity is placed on top of the boiler, in the place generally occupied by the sand-box (which is minus on this engine) and driven by a small tri-cylinder engine immediately behind it, and in front of the dome. Electricity is conducted from the dynamo to the tires of the drivers, and as they become thoroughly magnetized their attraction to the steel rails is supposed to prevent slipping, and greatly increase the adhesion of the engine to the track. It is claimed that a locomotive loses one-third of its power by slipping in starting a heavy train, which is to be obviated by the use of this contrivance. So far, however, the results reached have not been as satisfactory as might have been desired, in fact, some of them say that a pinch of sand is worth twenty dynamos on a wet rail, and in starting out. All parts of the engine that are not to be charged are carefully insulated. A non-conducting substance (probably compressed paper) is placed around all her rod bushings, between the wheel centers and driving-boxes, and all precautions are taken that nothing will be magnetized but the tires. This plan has probably been tried before, but this is the first time on this road. The question of electricity *vs.* sand, is an interesting one, if nothing else. The sand-box has been an important accessory to a locomotive for some time, has been extremely useful for the purpose for which it was intended, and from an economical point of view has cost next to nothing. But these are not reasons why something much better should not supersede it. But whether that "something" is the dynamo on the "806," I am unable, at present, to say.

Baltimore, Md. ROBERT H. ROGERS.

A Lucky Coupler, Even the Angels Want It.

Editor The Locomotive Engineer:

Having read the article, "The Coupler War," in your valuable paper of March, will you permit me to explain in your columns why the vertical hook coupler has made so many coupler men sick?

It is the fact that the hooks now in use are weak in structural form; the metal is not distributed so as to strengthen the weak points, and the miserable and costly excuses of uncoupling attachments now in use are continually broken or non-workable.

The vertical hook is the only device yet invented that avoids the high car carrying the low car, and it would cost a trifle in comparison to attempting to keep cars to a uniform height.

The Ferguson hook is at least 50 per cent. stronger than any hook now in service made of same quality and weight of metal, and the uncoupling attachments are so simple that the angels would hail their adoption with delight, as they would prevent the expletives now considered necessary to do work with these old devices. GEO. J. FERGUSON.

Greenville, Tex.

[Perhaps the angels would kick, if they had to face the repair bills.

Did Engineer Hood do Right in Running With one Eccentric Rod Down?

Editor The Locomotive Engineer:

On reading about the exact conditions of engineer L. L. Hood's accident on D. S., S. & A. railway by breaking the left back-up eccentric, I venture to give my opinion.

In the first place I think he did wrong by putting reverse lever in extreme forward notch, and blocking link down solid on link block, thus giving the valve a little more than its usual travel, and allowing steam to get into the other port.

Second, having lever in extreme notch would allow the bottom end of link to come in line with top end, or other eccentric rod, and would bind and break the other eccentric, or whatever was the weakest part on that side.

Third, when he came to the conclusion to leave up his other eccentric and block his link, if he had put his lever in about half its distance of forward motion, and then blocking, instead of putting it in extreme notch, he would have been using better judgment; for which I will give my reasons.

When the lever would be in about half its distance in forward motion it would give the valve and link a shorter stroke, and would not let the link travel so far as to get in line with the top end, and bind; for when the lever is in extreme notch the link would travel so far, the bottom end would come in line with top end, and you cannot move link or lever, with the block in or out, without taking a bar and prying bottom end of link down, and my opinion is that it was more by good luck than through good management that he came in all right by using his way of blocking.

It would have been better to take down both eccentrics on that side under these conditions, and did the best he could, for with the block he was putting double the work on the other eccentric that it was made to do; and if he had paid a little more attention to the eccentrics, and had those set-screw holes plugged up, as they ought to be, the accident would not have happened.

A READING ENGINEER.

Marquette, Mich.

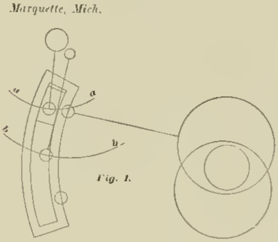


Fig. 1.

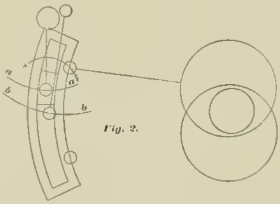


Fig. 2.

[Putting lever in the extreme forward notch does not let the top of the link strike the block, as long as his link hanger was up he was safe here. Increasing the travel will not admit steam to the other port. As to the lower end of link swinging up so that the top connection would come in line, forward or back of the link block pin, and bind, the tendency that way will be least the way Hood disconnected. Take a look at the skeleton sketches on this page. Fig. 1 shows the manner in which the engine was run, the eccentric blade connection is just opposite the die or link block, and the movement of the eccentric strap has little tendency to swing the link, and this tendency is counteracted by the hanger that obliges the center of the link to swing on the radius *b b* (which is nearly like that of the lower arm of the rocker *a a*), the weight of the link and the block that was fitted into the lower end of the link. Had the blocking been done as you suggest, shown in outline in Fig. 2, the link block would have been between the forward eccentric blade connection and the suspension stud, and the movement of the eccentric strap would have had a tendency to move the top of the link in the direction of the arrow, and around the link block pin; this, of course, would have greatly strained the hanger connections, and probably broken some thing. By disconnecting the lower or back-up blade, no more extra work is put upon the forward motion one than would be in working the engine full stroke, when all right; in that case the back-up blade merely prevents the lower end of the link from swinging—the top blade does the work. Any plan that will insure the lower end of link from swinging can be used, but nothing will succeed unless at full stroke, for the reasons pointed out. No fault could have been found with Hood if he had taken down both blades and disconnected his engine, but under the circumstances he did the best thing. Your last point has nothing to do with the question—the damage was done, and the question was to come the nearest to regular service with the least delay and risk that the circumstances would warrant.]

Why Truck Flanges Cut.

Editor The Locomotive Engineer:

I have been keeping track of a lot of engines with all manner and shapes of trucks, with a view to finding out something about the cause of flange wear. I want some information on this subject, and will make a few assertions just to call out some discussion or some history of experience.

We have a lot of modern swing-motion trucks, with steel-tired wheels, under 8-wheelers, about as many more with rigid center trucks, some resting on small center bearings only, some on large centers (24 inches), Mason style, and others that have a small center, but are side bearing. You would naturally think that the easiest truck to round a curve would wear its tire least, but the old-fashioned side-bearing trucks and the old Mason centers seemed to do better than the small center bearing or the swing motion.

Three years ago I put some engines with each kind of truck on one of our divisions, that is practically without a curve—and the flanges wore nearly, if not quite, as badly as on the crooked divisions. As before, the wide center and the side-bearing trucks did the best—why? By riding on the different engines I came to the conclusion that the cause of flange wear—where the engine is in tram, and the truck frame square—is not on account of the curves, but on account of the constant vibration of the truck. The swing-motion truck crowded the rail one side or the other at every low joint, and was constantly changing from side to side at every move of the engine—as the fireman expressed it, "it wiggles." The rigid, small center truck did the same, while the side bearing truck ran steadily and stiffly, and every time the engine lurched the side-bearing or the weight on one edge of the wide center at once brought the front of the engine back to center, and had things running in line. On the swing truck the engine came back to center slower, and was easier to move out.

I came to the conclusion that flanges wear more from "wiggle" than from curving. What do the readers of THE LOCOMOTIVE ENGINEER think?

A SOUTHERN MASTER MECHANIC.

Wants Us to Have a Sure Thing.

Editor The Locomotive Engineer:

I have read the paper since its first issue, and think enough of it to send for the bound volumes for the three years. There are some men in this country that have never read it—some don't want to read anything about a locomotive—the place to learn is to be on board of one, etc., etc. I differ from a good many that way; I read and re-read all I can find that will better me in my calling, and I have been running a locomotive in road service for fifteen years. I think if the managers of our railroads would subscribe for your paper and furnish each engine crew with a copy, and have them receipt for them, same as the time card, it would be like bread cast upon the waters—it would return to them tenfold at the end of the year in net earnings for the company.

If they would scatter them through the shops and roundhouses, and read them themselves, it would do some of them good. I send you eleven names, including myself, for three bound volumes each, for '88, '89, and '90. We all like it here.

Fond Du Lac, Wis. G. F. MCEVOY.

[Bro. McEvoy's plan would no doubt be a pleasant thing for us and many of the "boys in blue" (overalls), but we don't expect to see this kind of a millennium. We are satisfied with "friends like these," who know a good thing when they see it, and are willing to pay for it.]

The Rogers Locomotive Works are building three heavy decapods—10 wheels connected—for the C., B. & Q.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS

Making Changes.

When you are promoted to take another man's place, don't think that your reputation depends upon how many changes you can make in the existing order of things. This is especially true where your predecessor has been a successful man and has left to better himself.

Look around you, study conditions, and perhaps you will find a good reason why some things are different from what you are used to or would advise. A fairly well-organized place will run itself for awhile, you simply get on and ride, keeping your eyes open.

Don't make too many reforms at once, make those that show results first, without antagonizing the men under you. Old hands are very valuable to a new head.

Never make a change except with a view to economy, safety, or increased efficiency—never for the simple sake of change. A manager's success depends very much more upon what he *don't* do than upon what he does.

The Reason Compound Air-pumps Will Show No Economy.

There has been considerable talk of late about the economy of compound air-pumps, or other forms than the ones in general use.

That these pumps will supply a given pressure of air with the expenditure of less heat, or, in other words, less steam, no one will dispute; but here come in the conditions of service that make the economy useless.

When a locomotive is running the brakes are released, and the pump governor has the pump choked off—it is simply pumping enough air to supply the leaks. Brakes are never applied except when the throttle is shut, and when the brakes are applied the governor at once sets the pump going to supply the place of the air used, and it simply uses steam that would otherwise escape at the safety valve.

In nine cases out of ten there is much more steam wasted at the pop than the pump uses.

Complicating the pumps to save steam is the opposite of economy—it will cost too much to maintain them.

Advantage of Drop Tables Over Cranes for Repair Work.

Cranes have become very stylish of late for locomotive repair shops, and many master mechanics have figured on how much they could save if they only had a big traveling crane in the shops.

Besides the large investment of a crane, it has a disadvantage in that it takes power all the time to operate it, or the shafting running it; it requires a man in attendance all the time, and is a candidate for some repairs and considerable oil.

For manufacturing it is all right and will pay, but for repair shop practice we do not think it any better nor near as economical as a good drop table.

The table uses no power except when actually at work; there is no attendant, not one-tenth the investment planted, occupies no room when not in use, is not in the way of belting, and is fully as efficient in getting the running gear out from under a locomotive as is a crane.

A well-arranged table with hydraulic or air cylinders for moving an engine makes the table work quick and easy.

For running repairs, where it is desirable to remove a pair of drivers or a truck, there is nothing quicker and easier than the Vreeland transfer jack, and no large roundhouse is complete without it.

Pressed Steel Parts—Diversity of Sizes.

At the March meeting of the N. Y. Railroad Club, Mr. Chas. T. Schoen read a very interesting paper on the use of pressed steel parts for car work. Among other things he mentioned the fact that the cost of pressed steel parts was greatly increased on account of the great diversity in sizes used, his works having on hand, in less than three years' experience, some seventy-odd dies for center plates alone, and half as many for stake pockets and corner bands. He blamed the motive power and rolling stock officials in a measure for not adopting and adhering more to standard sizes.

Geo. W. West, Superintendent of M. P. of the N. Y., Ontario & Western, however, stated that his road was using pressed steel parts made by the speaker's house, and that they never were consulted as to whether sizes in stock would do, but were asked to furnish cast-iron centers, etc., so that the steel could be made to interchange.

Mr. Blackall, Superintendent of M. P. of the D. & H. C. Co., stated their road had the same experience, and he did not think it fair to lay it all to the motive power men.

The Master Car Builders ought to have a standard size for all these small parts, and the cost of repairs would be reduced by adhering to it.

We must not forget, however, that there are over one million cars running in the United States, and in substituting steel for iron in old work it is very necessary that the pieces be so built as to go on in place of the old cast-iron parts. No road can afford to throw away center plates or stake pockets to come to a standard, while there is just as much service to be got out of an old piece as a new one for running repairs.

Mr. Schoen gave some very interesting figures on the economy possible by reducing dead weight of cars by the employment of pressed steel in place of cast-iron.

Eugene V. Debs.

Eugene V. Debs, by far the ablest labor speaker and writer in America, has resigned his position as grand secretary and treasurer of the Brotherhood of Locomotive Firemen, and editor of their *Magazine*. Debs has not yet vacated his office, but stands ready to do so when his successor is appointed. To the honesty, intelligence, ability and untiring energy of Eugene V. Debs, the B. L. F. owes its present prosperity, and probably its existence, and we do not doubt but that the members of the order give him full credit. We were in the order ourself when the sun didn't shine very often.

It is to be regretted that Brother Debs has decided on this step—it will be hard to fill his place—but as far as he is personally concerned, he has the necessary qualifications to leave more fame and fortune behind him than can be found within the necessarily prescribed limits of one order.

Eugene V. Debs is not a man who needs the offer of a "place"—he will make a place for himself.

He has not, as yet, publicly announced his plans, but it is pretty generally understood that he will start a paper. If he follows any old plan, or cites any precedents to go by, it will be the first time he has done so; and if he does not show us something new, crisp, clean and sharp, he will fail to continue on the lines he has long ago established.

Eugene V. Debs is a labor agitator, and is proud of it. He is as honest as daylight, and does not hesitate to aid what he thinks is right, and kick what he thinks is wrong—find it where he may.

When he dips his pen in gall and reaches for a victim, he flays him alive—there is no mistaking what he means. Sometimes we have thought he fought too courageously, defeated the ends he sought by bearing down too hard, but we have only to think how, years ago, he borrowed money of his mother to pay up the debts of the Brotherhood, we have only to think of the millions of dollars that he has collected in pittances, and paid to the widows and orphans of the order, without the loss of a penny; we have only to think of the money, meals and encouraging words he has given to suffering brothers or "the tramp"; we have only to think of the sleepless nights and days he has worked over his books and his copy to keep up the spirit and interest of the order, when we love him more and more.

He has made mistakes and made enemies—only the fool has no enemies—but he has already contributed a lifetime of good to his fellow man.

Eugene V. Debs has a warm place in the hearts of thousands of American railroad men, who stand ready to aid him in any undertaking he may put his hand to—he can have half our shirt "on sight."

ASKED & ANSWERED

(30) Young Machinist, Chicago, Ill.,

Wants to know the value of lap of valve and the functions of the eccentric. The subject is too long for this column. Buy Forney's Catechism of the Locomotive; price, $2.50. It will tell you all you want to know in such simple language that you cannot fail to understand, if you think of the subject as you read.

(31) E. Gibson, Wilmington, Del., asks.

1. At what point is the crank pin when it receives its greatest strain? 2. At what point is the pin when an engine is most liable to slip? *A.*—1. At the beginning of the stroke, because the pressure on the piston is greatest there. 2. Slipping takes place most when the crank-pins on each side are below the center, the most wear generally showing almost directly in front of the right-hand crank-pins.

(32) W. H., Pine Bluff, Ark., writes:

A locomotive is working hard with 25 loads, throttle half open and lever near the corner, she breaks off five cars and starts ahead with them. The throttle nor lever have not been touched, yet the exhaust is easier and lighter. Why? *A.*—The exhausts take place closer together and sound lighter, and after the engine has gained speed there is not the time for the cylinders to fill with steam that there is when moving slowly and cutting off so late in the stroke. Steam does not have time to get in, thus less is used, and the exhaust is lighter.

(33) J. H. D., Kalkaska, Mich., asks:

1. How much more will an engine pull up a grade two hundred feet to the mile with 120 pounds of steam than it will with sixty? 2. What would be the percentage of the hauling capacity of an eight-wheeled Baldwin engine on a grade 66⅔ feet to the mile? *A.*—1. In this case grade does not enter into the problem; it is simply a matter of pressure, the engine's hauling power will depend upon the mean effective pressure, which in this case will be about double for the higher pressure. 2. About 19 or 20 per cent of its capacity on a level, conditions varying the capacity very much.

(34) J. P., Ishpeming, Mich., asks.

Does smoke enter the cylinders when engine is running with steam shut off, especially when air-pump is working? *A.*—No. The tendency is to pump the air out of the chest and steam pipes into the nozzles, and there is, under the circumstances named, a partial vacuum in the chest, proven by the "suck" on the oil pipes. Where there are no relief valves this vacuum is generally governed by the weight of the valve, which will lift when the pressure under it becomes strong enough. The packing will usually leak enough to supply the needed air. When the motion is reversed is when smoke and cinders go down the nozzles to the cylinders and chests.

(35) H. Williams, Moosic, Pa., asks.

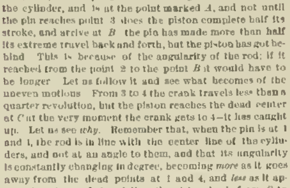
How do you figure the horse-power of a locomotive? *A.*—It is customary to allow half the boiler pressure for the mean effective pressure, which is the average pressure from the beginning to end of stroke. The following rule is used for any engine, and where used for a locomotive the result should be doubled, because a locomotive has two cylinders. *Rule.* Multiply the mean effective pressure in pounds on a square inch of piston by the length of stroke of piston in feet, multiply this product by the area in square inches of the piston, and again multiply this last product by the number of strokes made by the piston in one minute, and lastly, divide this total product by the 33,000, the quotient will be the indicated horse-power. Probably the following formula will help to impress this rule on the memory: Let *I. H. P.* stand for indicated horse-power; *P* for the mean effective pressure in pounds on a square inch of piston; *L* the length of stroke in feet; *A* the area of the piston in square inches; *N* the number of strokes made by the piston in one minute. We then have

$$I.\ H.\ P. = \frac{P\ L\ A\ N}{33{,}000}.$$

Here it must not be understood that the word *P L A N* has any particular relation to the horse-power of an engine, but the letters forming this word should simply be understood to be symbols of the factors which enter into the calculation, neither does it make any difference in which order we take the factors, but placing them in the order here given, they form the word *PLAN*, which may help to impress the rule upon the memory. The divisor 33,000 stands for that many foot-pounds. An engine which raises 33,000 pounds through one foot in one minute is said to exert one horse-power. This unit of horse power was established by Watt, and has been in use ever since.

(36) Not Posted, Philadelphia, Pa., asks

Please explain through your paper what is angularity in side and main rods, and what effect it has on the engine. *A.*—Side rods have no angularity, because they are always parallel to the piston that moves them. What is known as the angularity of the rod affects the motion of the piston, and makes it necessary to change the motion of the valve to correspond to the irregular motion of the piston. The accompanying outline sketch of the crank-pin, piston and main rod will help to make the matter clear. It is perfectly plain that when the crank-pin is at 1 or at 4 the piston will be at *D* or *C*, the extreme end of the cylinder. As the piston and crosshead are keyed solidly together, we will consider only the motion of one, as in this case their motions are exactly the same. The angularity of the rod always decreases by increasing the length of rod; so in this case we show the rod but half the usual length, as compared to the proportions of other parts; this will serve to show the effect of angularity more plainly. Now, suppose we start the pin from 1 in the direction of the arrow; at 2 the crank has traveled over one-quarter of its path, or 90° of the circle, but the piston has failed to get to the center of the cylinder, and is at the point marked *A*, and not until the pin reaches point 3 does the piston complete half its stroke, and arrive at *B*; the pin has made more than half its extreme travel back and forth, but the piston has got behind. This is because of the angularity of the rod; if it reached from the point 2 to the point *B* it would have to be longer. Let us follow it and see what becomes of the uneven motions. From 3 to 4 the crank travels less than a quarter revolution, but the piston reaches the dead center at *C* at the very moment the crank gets to 4—it has caught up. Let us see *why*. Remember that, when the pin is at 1 and 4, the rod is in line with the center line of the cylinders, and not at an angle to them, and that its angularity is constantly changing in degree, becoming *more* as it goes away from the dead points at 1 and 4, and *less* as it approaches them. Let us follow the piston back from *C* to the center of the cylinder at *B*. You will see that the pin has only got to 5; the constantly increasing angularity has made the piston travel a full half stroke before the pin has



got to the quarter, the piston reaches *A* again when the pin gets to 6, the quarter, but the moment the pin gets past 6 the angularity of the rod commences to decrease till it reaches 1 again, which it does by the time the piston is at the end of the cylinder at *D*. You see, the pin has to travel from 5 clear around to 3, in order to make the piston go from the center of the cylinder to the back head and to the center again, while it only has to go from 3 to 5—a considerable shorter distance—to make the piston go from the center of the cylinder to the front at *C*, and back to the center. Something is working unevenly. What is it? The fly wheel, in a stationary, and the moving weight of engine and train in a locomotive, act as governors that prevent uneven impulses given to the pistons from affecting the regular rotary motion of the crank-pin, and, as that is coupled to the piston by the main rod, the result is that the pistons travel unevenly; not only do they stop and start at each end of the stroke, but they make one-half their journey quicker than they do the other half. In a full revolution of the crank the piston will always travel the *least* while the crank is making the half revolution farthest from the piston, and travel the *most* while making the half revolution nearest the piston. In locomotive practice it is customary to place the center line of cylinders slightly above the center line of the wheels, and this increases the angularity on the lower half of the crank-pin's path, and decreases it in the upper half; but this change is so slight that locomotive builders, as a rule, ignore it. The motion of the valves of a locomotive are derived from eccentrics fixed upon the axle, and coincide more nearly with the motion of the main pin than the piston, so that something must be done with the valves to equalize the point of cut-off for the uneven motion of the pistons. In the ordinary link motion this is done by changing the point of suspension, or saddle-pin, of the links.

The Coming Locomotive—A Reply to Mr. Sinclair's Criticism of Single Engines.

Facts outweigh the profoundest and most ingenious speculation.

Angus Sinclair, in *The National Car and Locomotive Builder*, says, "To talk of employing 'single' driver locomotives at this day is trifling with a serious subject." Before making the above statement, it would have been well had Mr. Sinclair made sure of his facts.

Mr. Sinclair further says, "Mr. Le Van is not a railroad man, and never has had anything to do with the designing of locomotives." . . . Will Mr. Sinclair tell us what constitutes a railroad man? Mr. Le Van has designed and built a locomotive. Has Mr. Sinclair ever built and designed one?

It is not the province of a railroad man to build and design locomotives. That work comes under the head of dynamics, and should be referred to the engineering branch of the company. The best evidence of this is found in the manner that the majority of locomotives are designed and constructed by "railroad men." In engines so designed and constructed, the high-pressure steam from the boiler is passed into a large rectangular steam port, and, after being expanded four or five times, is forced through an exhaust nozzle, one-fourth the area of the inlet, or, in plain terms, it is let in at the big end of a funnel, and expected, after expanding to four times its volume, to get out of the small end in less than one-half the time occupied for its inlet.

He further says, "The question of running fast trains has presented itself to Mr. Le Van in a one-sided and rather impracticable fashion."

Mr. Le Van's experience has been that of every ordinary mechanic; he served an apprenticeship under Stillman, Allen & Co., of New York City, as a machinist, and attained a fair ordinary common education, and for the last forty years has been continually and exclusively engaged in designing, constructing and superintending different kinds of machinery and boilers, having had three years' experience as a marine engineer, and was a manufacturer of steam engines and other machinery, including that of cotton, woolen and paper-mills for over ten years. I have also been employed as an expert by the City of Philadelphia, in relation to their pumping machinery for its water supply, and have for the last twenty years been employed as an expert in regard to the construction and operation of machinery in patent cases, and similar suits in our courts. I have also been a member of the Franklin Institute for the last thirty years, and one of its board of managers for thirteen years, and also a member of the American Society of Mechanical Engineers since its organization.

In the course of my business experience I have for a number of years visited New York City once a week, and consequently know "the conditions under which railroad trains are operated," . . . . "and the existing conditions that require the steam to be shut off and speed reduced." . . . English railways have just the same conditions to contend with in the above respect as the Pennsylvania and other roads.

In the race to Edinburgh, in 1888, the locomotives had the same contention to deal with; on the east coast route the speed was restricted to ten miles an hour through Peterborough, Darlington, Maspeth and Berwick, and through six other towns from ten to twenty-five miles an hour, beside other delays, and still the average speed was 54½ miles an hour with a 200 ton train.

Then again, Mr. Sinclair knows, as well as Mr. Le Van does, that the Pennsylvania Railroad Company runs both the States of Pennsylvania and New Jersey legislatures, and can have only such restrictions imposed as they may want.

In the spring of 1884, Mr. Le Van read a paper before the Franklin Institute, and also before the American Society of Mechanical Engineers, in which he undertook to establish the fact that the distance between New York and Chicago could be covered in seventeen hours, or at an average speed of fifty-five miles an hour. This paper was submitted, prior to the reading, to the general manager of the Pennsylvania Railroad Company, who said there would be no difficulty in carrying it out as stated. The race from London to Edinburgh, in 1888, shows conclusively that there is no difficulty in so doing, as the above speed was exceeded on that occasion for a distance of 400 miles, covering thirty days runs.

It is a well-known fact, and no one knows it better than Mr. Sinclair does, that the English locomotives use much less fuel for the load moved than our American locomotives do; and one of the best evidences of this fact is close at hand, by comparing, namely, the fuel consumption of the English locomotive now running between Philadelphia and New York, with the consumption of fuel by one of the best American locomotives on the same road, and *doing similar work*.

Now this locomotive is virtually a "single" locomotive. Mr. Webb's object in introducing this locomotive was to secure, in the first place, a greater economy of fuel, and, secondly, to do away with parallel rods, the "weak link in the chain of mechanism at high speeds," they being "the principal drawback to a coupled engine." Mr. Webb, by his arrangement, at the same time obtains increased adhesions, with the freedom of a "single" locomotive.

Mr. Sinclair says, in a paper on "Economy of Fuel," read before the Master Mechanics Association, "While I stand second to none in admiration of the American locomotive, I think there is a possibility of making it lighter on fuel." The

Webb locomotive hauls five cars and makes seven stops in 124 minutes, between New York and Philadelphia. The coupled locomotives can do no better, and consume nearly 30 per cent. more fuel. The former having 1,400 square feet of heating surface, and 19 square feet of fire surface; the latter having 1,205 square feet of heating surface, and 85 square feet of grate surface.

Twenty years ago, Mr. Patrick Stirling, superintendent of the Great Northern Railway of England, built, and up to present date continues to build, and run "single" locomotives with great success, as well as economy of fuel, and they are noted in England for their efficiency. The traffic is exceedingly heavy, and the trains are run at a high rate, the average speed of the Flying Scotchman being 50 miles an hour, and no trains in England make better time. These trains average, including engine and tender, 228 tons weight, and the coal consumption per mile averages 22.6 pounds. Mr. Stirling conducts his traffic at a higher rate of speed, and with equal punctuality, with his eight feet "single" locomotives, than does Mr. Webb of the Northwestern with coupled locomotives, and the economy of fuel of the former over the latter is very remarkable.

In the race from London to Edinburgh, "single" locomotives on both the routes carried off the palm, and the most interesting feature was the run from London to Crewe—158 miles—without a stop, and by a locomotive twenty-five years old, and a *single* at that, having cylinders 17x24 inches, with 7-feet 7-inch drivers, and 1,098 square feet of heating surface, and 15 square feet of grate surface. Taking modern locomotives as a standard, this is a small locomotive, being only 22½ per cent. of weight of the load hauled; the average speed was 54 miles an hour.

Mr. Johnson, superintendent of the Midland, England, since 1887, has adopted the "26" class of "single" locomotives for his flying trains; cylinders, 18x26 inches; driving wheels, 88 inches in diameter; heating surface, 1,240 square feet; grate surface, 20 square feet. The loads hauled by these locomotives average 244 tons weight, with a coal consumption of 26 pounds per mile, and average speed is 48 miles an hour.

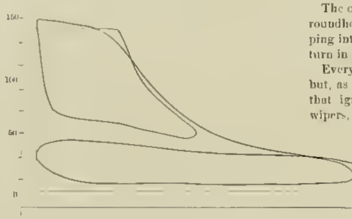
At the present time all of the best railways in England are adopting "single" locomotives for their fast trains. The advantages of English locomotives over American locomotives for fast speed and economy in fuel is in their adoption of large diameter driving wheels, and large exhaust nozzle area, the former reducing the number of revolutions per mile, thus producing a slow draught, allowing the products of combustion time for passing through the flues, so as to give up the greater portion of the heat evolved, thus effecting a higher evaporation per pound of coal burnt, and the latter reducing the back pressure on the pistons, the occurrence of which is the great drawback to high speeds; the trouble is not to get the steam into the cylinder, but to get it out quickly.

It is undeniable that for trains within their adhesive powers no class of locomotives can run with so much freedom and steadiness, and with so little *wear* and *tear* to the machine, and permanent way, at very high speeds, as the single driving wheel locomotives.

Mr. Sinclair says: "The conditions under which railroad trains are operated will, however, prevent them from imitating English practice. If the ninety miles run from Jersey City to Philadelphia could be made without the engineer being required to shut off steam more than once, the fundamental condition on which British fast train operating is based would be paralleled, and a large wheeled locomotive with limited adhesion would be in her proper element. As the existing conditions require the steam to be shut off, and speed reduced ten or twelve times, the designer of locomotives provides the kind of engines adapted for lifting the train quickly into speed, and nothing else will do."

Now Mr. Sinclair, like those he calls "railroad men," will build locomotives suited to start their trains with, *which involves not three per cent. of the work to be performed, therefore making them wasteful for the ninety-seven per cent. of the power to be developed to haul the moving load.* This is why the English locomotives excel ours in speed, and are so much more economical in fuel than the American locomotives. Their trains and locomotives are adapted for each other, and this is why the former towers above the latter, as the Eiffel does above the Washington monument.

Mr. Sinclair says: "Trains are becoming so heavy that two pairs of drivers and a four-wheel truck will not carry the weight of the boiler and cylinder necessary to provide the required power." Now the fact is that three fourths of the trains running between New York, Philadelphia and Washington, on both the Pennsylvania and Baltimore & Ohio railroads do not exceed 225 tons weight, including locomotive and tender, which can be hauled at the rate of fifty miles an hour by a first class single locomotive with a coal consumption not exceeding thirty pounds per mile. And this is just what the best English railway companies are doing, including the Great Western, which is operated for forty-nine per cent. of its gross receipts; the Midland, the passenger traffic furnishing thirty per cent. of the gross receipts, and which pays *six per cent.* dividends on its ordinary stock. The Great Northern for the last twenty-five years has used singles for its fast passenger traffic, with a coal consumption not exceeding twenty-three pounds per mile, also the Caledonian, Manchester, Sheffield & Lincoln, and several other lines are arranging for singles. Mr. Worsdell, of the Northeastern, has in all his late fast compounds adopted single drivers 7 feet 7½ inches in diameter. With a special train of eighteen six-wheeled carriages a speed of about ninety miles per hour, the highest on record by several miles, was obtained. Indicator diagrams were taken on this trip; one set was taken at a speed of eighty-six miles per hour on the level. The speed was carefully measured by a stop watch and mile posts, the quarter-mile posts being frequently registered during the trip, the shortest time was just over ten seconds per quarter mile. The following indicator diagram was taken at a speed of seventy five miles per hour



Total weight of locomotive, tender, and train, 310 tons, 6 cwt., high-pressure cylinder, 20 inches diameter; low-pressure cylinder, 28 inches; stroke, 24 inches; driving wheels (single), 7 feet 7½ inches; high-pressure cut-off, at 47 per cent.; low-pressure cut-off, 67 per cent. of the stroke; total indicated horse-power, 1041.4. Heating surface in flues, 1,016 square feet; heating surface in fire-box, 123 square feet. Total, 1,139 square feet. Grate area, 20 square feet. Coal consumption, 28.4 pounds per mile.

The highest indicated horse-power on this trial was obtained at a speed of eighty-six miles an hour, namely, 1,068, boiler pressure, 175 pounds. From the above it will be seen that Mr. Sinclair's statement, that "Locomotives with single pair of driving wheels had their day . . . the American locomotive . . . did admirable service, but the indications are that its days as the motive power for fast passenger trains are nearly over, the mogul and ten-wheel locomotive are slowly taking the place; they will eventually monopolize," is simply ridiculous in the extreme.

With the introduction of steel rails, and that of the steam sanding apparatus now in general use on the majority of the best flying trains in England, it has been demonstrated that a single pair of driving wheels can carry as much as twenty tons, where before fourteen tons was the maximum load. The latter improvement has brought the single locomotive into the front rank for fast train service. To accomplish sixty miles in sixty minutes consecutively the compound system and a single pair of driving wheels will have to be resorted to. The race in 1888 between London and Edinburgh showed that the best average consecutive miles per hour was fifty five and one-half miles. Therefore, compounding will have to be substituted so as to utilize all the power developed by the boiler, as well as the heat units now wasted in the high back pressure due to excessive compression.

WM. BARNET LE VAN.

Philadelphia, Pa.

A Pie eating Ghost.

Way back in the early days on the Rio Grande—1875 was pretty early in the early days—the management bought an English locomotive, one of Fairlie's double enders.

This peculiar old scrap was odd in every way—devilish odd. She had four cylinders, two stacks, etc. Her cab was something between a freight car and a pump house, and was located in the center of the boiler. This cab was some two feet wider than any other cab on the road—if it hadn't been, this tale would never have been told.

On top of this cab there was a cheap, cast iron bell that made a noise something like the rattle of a big bunch of keys.

After the first year none of the regular men would fire the Farlie, except a little Cornishman who answered to the name of Fairlie Jim.

Early in his career Jim had been laid off ten days for not ringing the bell at a crossing, so he made up for lost time by ringing the old rattle-box on the Fairlie all the time when not actually putting in a fire. He soon became noted for perpetual bell ringing; night or day, in the yard or on the road, Jim jingled the bell and leaned lazily out of the side window.

But one day the Fairlie was sent over a new division, where no calculations had been made for her wide cab, and a steam pipe to a pump where some bridge work was going on did not clear enough, and Fairlie Jim's head was taken off, and the bell stopped.

The old engine was brought back to the Denver roundhouse and stored away in an odd pit, dropping into a season of slothful idleness awaiting her turn in the shop.

Everybody wanted to go firing out there then, but, as usual, the roundhouse foreman thought that ignorance was the proper qualification for wipers, and yet he wanted wipers to become firemen and firemen to become engineers; so the majority of the wipers were ignorant, and, being ignorant, were superstitious.

There was one bright young fellow wiping, and praying for his turn to go firing; he was smart, but he did not look it. There was a spirit of fun in him, and by pretending ignorance and the belief in all signs and other forms of superstition, he managed to keep his co-workers talking and telling something for his especial edification.

The night foreman was a fun-loving young man also, and helped his friend the wiper enjoy himself.

When the Fairlie came in, after killing Jim, our wiper friend told the crew all about her and Farlie Jim, and added, much to their amazement, that every night at exactly twelve o'clock Jim came to the engine and rang the bell; he elaborated his lie as interest grew on it, and by ten o'clock had all hands truly excited, but somewhat incredulous, then he slipped away and told his friend—the foreman.

This worthy at once attached a string to the Fairlie's bell and ran it where it could not be seen to his desk.

Promptly at 12 o'clock the cracked tones of the Fairlie's bell rang through the house, and our wiper friend, assuming great fright, dropped his torch and dove for a door, closely followed by the crew of night hawks. The man who appeared to believe his own story led the frightened crowd into the supply yard, where tons of castings, timber, piles of wheels, tires, pumps, pile drives and trucks were concealed in the darkness, ready and willing to throw the wayfarer down and then jump on him.

When the bell stopped they all came back slowly, rubbing their chins, except one man—probably he's running yet. The next night the ghostly bell-ringer came back, but he was not satisfied with merely ringing the bell.

Our jokers had heard of another peculiarity of Jim's—he was an awful pie eater. Shortly after the gang got to work the next evening the humorous wiper asked a neighbor if he had any pie in his lunch the night before, and when he received a reply in the affirmative simply shook his head and kept still. When asked to explain he, apparently with great reluctance, told that he came to the house the night before sure that he had a piece of pie in his lunch pail, but that after the ringing of the bell he could not find it, and told what an awful pie spoiler poor Jim had been.

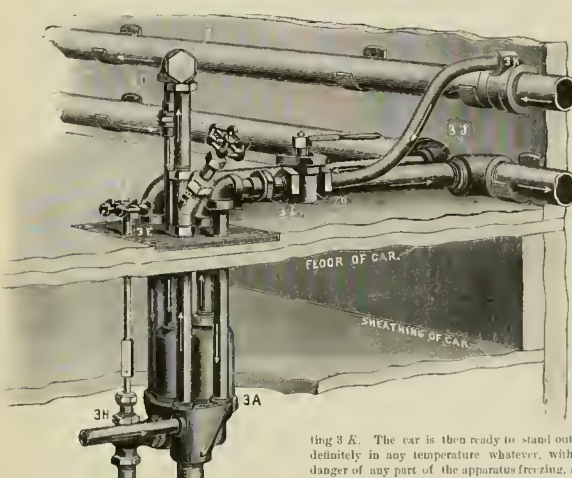
That night our wiper led the retreat again, and his side partner who did the ringing also lifted the pie out of every pail—their own included.

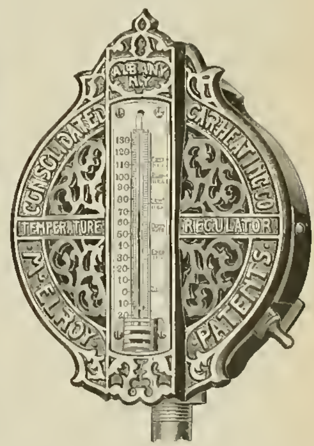
Our wiper told his comrades that he would be mortified to death to have it get out that he was scared lest he should see poor Jim—so they all agreed to keep still and wait for developments.

The boys lived on pie for a fortnight when the Fairlie was put into the back shop for repairs, just in time to save the two jokers from chronic dyspepsia.

Public Test of the Commingler Storage System of Car Heating and the Automatic Temperature Regulator.

On March 11th and 12th the Consolidated Car Heating Company, of Albany, N. Y., gave an exhibition of their heating devices on the trains of the





Delaware & Hudson Canal Co. running between Albany and Troy.

A large delegation of railroad officers and newspaper men attended. This company control several systems of car heating, only one of which was in use on the trains mentioned, their direct steam system being in extensive use, however, on other trains on the roads centering in Albany

The attraction of the exhibit was the McElroy Temperature Regulator for automatically controlling and regulating the heat in a car by the temperature of the air in the car itself.

In the commingler system of heating, direct steam is used to heat the car up at first, the water of condensation finally filling up the pipes and automatically changing itself to a hot-water storage system.

The commingler is a small device shown on the left of this page—two are used on each car.

Into this commingler 3 *A* steam enters from the train pipe, through the regulating valve 3 *B*, at very low pressure—about two pounds—and thence makes its way into the heating pipes of the car, following the course shown by the arrows in the cut. As heat is given out the steam condenses and the water of condensation returns to the lowest part of the system—the commingler 3 *A*—where additional steam is continually and noiselessly injected into the water. In this accumulating water heat is stored and mildly radiated therefrom.

When the piping is full the surplus condensation overflows through overflow fitting 3 *K*, and thence through the trap cock 29, down the pipe connected therewith to the drip, where it falls to the ground. The trap cock 29 takes the place of a thermostatic trap. The drip cannot freeze, as it is in metallic contact with the base of the commingler 3 *A*, which base is directly connected with the train pipe, and so is always heated with steam.

By opening the drain valve 3 *H*, controlled by the wheel 3 *F*, the water of condensation is drained from the system and the apparatus then becomes a simple direct steam system. When steam is first turned on the car is quickly heated by direct steam; wheel 3 *F* is then turned, the drain valve 3 *H* is so closed, and the direct steam system gradually and automatically converts itself into a hot-water circulating system.

At stations or elsewhere, if it is desired to avoid any drip, the trap cock 29 is shut, and not a drop of water can escape

When the car is laid off for the night, or for more than three or four hours (for three or four hours it will keep warm from stored heat), the drain valve 3 *H* and the regulating valve 3 *B* are opened, and the entire system is quickly emptied of water, air entering up through the drip pipe and overflow fitting 3 *K*. The car is then ready to stand out indefinitely in any temperature whatever, without danger of any part of the apparatus freezing, and is also in readiness to be quickly heated by direct steam, when again brought into use Like apparatus is placed on each side of the car, thus allowing each side to be heated separately One automatic regulator controls both comminglers.

The automatic temperature regulator (cut on right) is made in ornamental form and occupies but little space. A thermometer attached always shows the temperature of the car. The regulator is attached to the side of the car, at about the center, and is enclosed in a strong metal case of brass, bronze or nickel, as may be preferred. It can be placed in any car already piped for steam, with slight labor and with little or no change in the piping of the cars.

The temperature regulator is actuated by a fluid placed between two diaphragms which are brazed together at their edges. The fluid has a boiling point at sixty-eight degrees Fahrenheit and remains passive below that temperature. At sixty-eight degrees the fluid boils and exerts a pressure upon the diaphragms to force them apart. Suitable mechanism is employed to communicate the movement of the diaphragms to a vertical steel rod three-eighths inch in diameter, which is connected to a valve of special design admitting steam from the train pipe. This rod is enclosed within and protected by a half-inch iron pipe extending from the regulator to the special steam valve. No steam is admitted to this pipe, it serving merely to hold the parts which it connects in rigid adjustment and to prevent any interference with the rod. The movement of one-quarter inch takes place in the steam valve under a change of temperature of five degrees. The regulator closes readily against sixty pounds steam pressure.

These regulators are set to maintain a temperature in the car of seventy degrees Fahrenheit, unless ordered for other temperatures. They are made for sixty-eight, seventy, seventy-two and seventy-four degrees.

Every regulator is provided with a lever, shown at side in cut, which admits of a change of four degrees in the point at which the regulator will hold the temperature of a car. The standard regulator is designed to hold the temperature at seventy, with a possible range between sixty-eight and seventy-two degrees, depending on position of such lever

After the exhibition the editor of this paper made a trip over the D. & H. C. Co. in a train heated by this system and controlled by regulators. Every ventilator in the four cars was open, the air was fresh and pleasant and the temperature steadily stood at sixty-nine, not only by the thermometer on the instrument, but by two others at the ends of the cars. The trainmen do not touch the heating device, it cares for itself.

The idea of regulating the temperature in a train by an automatic device that takes notice of every disturbing element and meets it, instead of regulating by the hand of a green brakesman and the whims of the passengers is a grand improvement.

Patent Centennial Celebration.

Elaborate arrangements have been made to celebrate the beginning of the second century of the American patent system, at Washington, on the 8th, 9th and 10th of April next. President Harrison will open the celebration, and the literary exercises will be presided over by some of the most eminent inventors in the country Twenty addresses upon the different phases of invention will be delivered by men who are famous as masters of the subjects they will discuss. A national association of inventors and manufacturers of patented articles will be organized There will be a grand reception at the Patent Office by the Secretary of the Interior and Commissioner Mitchell, at which at which it is expected Cyrus W. Field, Thomas A. Edison, George Westinghouse, George M. Pullman and others will assist. There will be a military parade, a grand excursion to Mount Vernon, a planked shad banquet at Marshall Hall, near Mount Vernon, and the Navy Yard, the National Museum, the Patent Office, and other interesting national establishments will be open to the visitors.

This is the first time in the history of the republic that the inventors have celebrated.

The Head Liars.

Not long ago there was an important meeting of railroad presidents in this city to fix up some of their broken agreements, and President Stickney, of the Chicago, St. Paul & Kansas City road, among other forcible remarks, said:

"I believe that all the presidents here are honorable gentlemen, and, as private individuals, I would trust them with any amount of money. But as heads of railroads they are a lot of scoundrels, and I wouldn't believe them under oath, neither would I trust them with a cent out of my sight."

Not one of the gentlemen present seems to have resented this charge, and therefore practically acknowledged its truth.

Very few who know anything about it deny that the management of a great railroad property on the modern lines laid down calls for the perpetration of almost, if not all the crimes in the calendar—robbery, corruption, and bribery, to say the least—yet the worst of this is called "sharp financiering" or "good management." As the heads of our railroads are the virtual management, they are responsible for all questionable practices—and there are enough of them daily to send a banker or grocer to prison if he but slightly imitated them.

If an engineer or trainman is caught telling a lie about a little mishap on the road he is discharged. But the great big president will deliberately sign a cast iron contract just for the fun of breaking it to injure another line. President Stickney seems to have known who he was talking to.

Engineers Made to Order.

The Mexican executive has applied to Congress for authorization to spend what may be necessary, for the purpose of establishing in the Federal district a school for the practical training of young men in the handling of steam engines in general, but more particularly of locomotives. This school will be under the control of the Department of Public Works. The course of study will comprise the elementary branches of mathematics, mechanics, and natural philosophy, mechanical drawing, French, English, etc., but its salient features will be the acquisition of a practical acquaintance with the materials of which steam engines are manufactured, the mode of putting them together and taking them to pieces, of operating locomotives, practice in handling locomotives of peculiar pattern, and instruction in the rules governing the running of trains. A period of training in railroad shops, in foundries and mills will also enter the curriculum. After satisfactory examination in the branches named, pupils will be given a certificate of fitness.—*Ex.*

Granger Legislation.

A bill has been introduced in the Missouri legislature, which provides that no engineer shall be allowed to run a locomotive without first having three years' practical experience, and also to allow only those engineers having good moral characters to handle the levers. The bill does not undertake to explain how an engineer is to get three years' experience without running a locomotive.—*Ex.*

If the bill said three years' experience as a locomotive engineer *or fireman*, it would be well enough, and do no harm, if it did no good. Experience on the foot-plate is the only safe way to make engineers, but experience alone will not make an engineer of a basswood tobacco sign—some brains are necessary.

Original Inventors (?).

The *Times* advocates supplementary audible warning signals in the New York tunnel as a means of preventing mistakes in visual signals, as an original proposition. Considering the fact that the *Press* advanced this suggestion immediately after the tunnel accident, the palm for "cheek" belongs to our Mugwump contemporary, but not the palm for originality.—*N. Y. Press.*

Considering the fact that there were just such signals in use in the tunnel at the time of the accident, and that both these papers described it half a dozen times, it's hard to tell who made the original proposition, or has the most "cheek."

Verdict of the Coroner's Jury in the Tunnel Accident.

The following is the verdict of the coroner's jury which investigated the New York tunnel disaster:

The coroner's jury, summoned by Coroner Ferdinand Levy to inquire into the cause of the death of Helen T. Supple, Wm. Anton Zeilner, John H. Hencke, Michael Mullone, John B. Flynn and John Murray, in the Fourth avenue tunnel, on the morning of February 20, 1891, do find:

First—That the preponderance of evidence shows that the signals were properly set at danger at the time the New York, New Haven & Hartford train, called 10 Y, passed them in the morning of February 20, and the jury believe that, owing to the density of the atmosphere in the tunnel, due to the presence of fog, smoke and steam, Engineer Fowler, of the New York, New Haven & Hartford Railroad Company, did not clearly see the signal. It is further believed by the jury that Engineer Fowler did not hear the gong, if it rang on the day of the accident when his train passed the danger light.

Second—We find the New York, New Haven & Hartford Railroad Co., its officers and directors, are immediately responsible for the death of Helen T. Supple and the others heretofore mentioned, because of the failure of Engineer Fowler to distinguish the danger signal at Seventy-second street, and thus causing the collision with the "shop" train; and we further find that the New York, New Haven & Hartford Co., its officers and directors, are immediately responsible for the death by suffocation and burning of John Murray and Jas. B. Flynn, which was caused by the upsetting of a car stove in the Boston & Albany car, under the charge of the New York, New Haven & Hartford Railroad Co., and setting fire to the wreck by reason of the collision.

Third—We would urge the legislature to compel the New York Central & Hudson River Railroad Co. to make additional openings in the tunnel, in order to provide for better ventilation and light in said tunnel, as from personal examination we find that the present ventilation and light are inadequate; and we do further believe that the use of anthracite coal when additional openings are made will contribute to the safety of the traffic. We further believe that the present system of the use of one man in the signal cabs in the tunnel is insufficient for safety, and we earnestly recommend the employment of two at all times.

We further recommend that each outgoing and incoming train when passing through the tunnel be advised of the train immediately preceding it, and also its reasonable headway. And we further recommend that a uniform rate of speed be adopted for all trains and engines passing through the tunnel.

As will be seen, this jury put the blame of the accident upon the New Haven Road, and assume that the signals were right, and the engineer passed them while at danger.

The principal officers and directors of the consolidated road have been placed under heavy bonds.

Chauncy M. Depew has been on the witness stand, and pictured out all the horrors that may arise when an accident occurs to a steam-heated train, and condemned, *in toto*, the very practice the New York Central road has been proud to lead in—they refused to interchange cars with the P. R. R., because the latter were not steam-heated, and therefore unsafe. Mr. Depew has been hot on one side, and cold on the other. He has told a story apparently to help pull President Clark out of a bad hole—Mr. Clark dug the hole himself and ought to be left in it.

If one of Mr. Depew's engineers or conductors was called up before him, and contradicted his own story and his own actions half as bad as Mr. Depew himself has, Mr. Depew would probably come to the conclusion, if he did not then and there announce, that the man lied. To say the least, the president of the Central Hudson has set a very bad example to his men, and placed himself in a position that will cause him the loss of a large measure of the public respect.

On the Georgia Pacific and several other southern roads, they have in use a new form of boiler check, of which the men using them speak highly. Both checks are screwed into a large cast chamber located on top of the boiler, this chamber has a large valve at the bottom, that can be used to shut off connection with the boiler, so that one or both checks can be ground in, cleaned or renewed, with steam on. It is claimed that by locating the checks above the water line there is no trouble from their being held up by scale, and the pipes are so arranged that they empty themselves of water, and are in no danger of freezing up.

Very stringent orders have been issued to passenger conductors of railroads in the Chicago and Ohio River pool to examine carefully all mileage books presented by passengers, and take up those that look as though they came from a scalper's office. If the possessor of a map-of-Ireland face presents a book made out to Ikey Offenheimer, for instance, the conductor is expected to adjust his eye-glasses carefully, and after scrutinizing the face and the face of the book inform the passenger that he's onto him. Any dereliction of duty is likely to be followed by dismissal. On the theory that railroads have nought to do with scalpers this rule would seem to be a tough one to ticket brokers, but as it is a well-known fact that general passenger agents sometimes deal with these gentlemen, it may not be so great a hardship after all. It all depends.—*Cincinnati Times-Star.*

We have received from Eugene V. Debs, editor, a handsome bound volume of the *Locomotive Fireman's Magazine*, for 1890. The *Magazine* is the best "official organ" of any association of workingmen in this or any other country. It is run absolutely and entirely in the interests of its order, and, while we sometimes differ from the opinions expressed by its editor, we give him credit for being heart and soul in his work, and doing at all times what he thinks is best for the order. Bro. Debs has announced his intention to retire from the editorship, and if he does, his successor will do well to occasionally look over the files of the *Magazine*, and keep close to the general lines laid down there. Eugene V. Debs can always refer with pride to the ten volumes of the *Magazine* he created—there is not a dead letter in the set.

On the Connecticut River road they use quite a number of St. Johnsbury feed-water heaters. This heater is a box located just back of the cylinder saddle, and between the guides. The feed water is forced through a lot of brass tubes that are surrounded by exhaust steam, taken from the passages in the saddles. This heater heats the water, no mistake about that, but it takes, like all the rest of them, from Peter to pay Paul, in every case where used, the nozzles have been closed to make the engine steam. There is another fault, the friction of the water through the tortuous passages of the heater pipes puts a great deal of work on the pump, requiring more power to drive it, and making it necessary to pack constantly.

The Sewall steam hose coupler is fast becoming the standard coupler of the country, being already in use on 52 roads, representing a mileage of 37,562 miles, and having 7,080 passenger cars. McElroy and other couplers of the Consolidated Car Heating Co. are in use upon roads having a mileage of 8,188 miles, and having 2,557 passenger cars. These figures show the Consolidated Company's couplers now in use on a total mileage of 45,750 miles, and by railroads having 9,637 passenger cars, which are already equipped, or are to be equipped, for steam heat. It is to be hoped that the master car builders and the master mechanics will decide on a standard coupler, before there gets to be five or six thousand devices in the field.

A largely signed memorial has been presented to J. H. Olhausen, general superintendent of the Central Railroad of New Jersey, by the commuters, thanking the road for the introduction of the splendid new cars, and the Pintch system of gaslights, all of which tend to make life more endurable for them for about two hours per day. The new trains of the Central are praiseworthy, and the new engines are just as deserving. It is splendid stock. The spectacle of patrons thanking a railroad for good and efficient service in this day and age of kicking grangerism stands out like a diamond ring on a tramp's thumb.

Pullman will send a large force of carpenters, upholsterers and painters to Australia, to put together and finish the new cars he is building for that country. The cars are sold outright.

The Alabama Locomotive Works have been incorporated. Home office, Alabama City, Ala., capital stock, $1,000,000.

Examination of Locomotive Engineers and Firemen.

The Master Mechanics Committee appointed to investigate the subject of "Examination of Locomotive Engineers and Firemen, on their duties relating to the use of fuel, care of the locomotive, and ability to deal with disorder or disability of machinery, to what extent practiced and best plan for conducting the examination," request answers to the following questions:

No. 1.—Do you examine engineers employed from other roads on anything except time card rules? If, so what plan do you pursue and of what does the examination consist?

No. 2.—Do you examine firemen, candidates for promotion? and if so, what line of examination is followed?

No. 3.—In hiring men for firemen, what age do you consider the limit past the age of 21 years?

No. 4.—Do you advise the first year in service, as fireman, be on switch engine?

No. 5.—What do you consider the shortest time a fireman should serve in that branch of service before he is allowed examination for promotion to engineer? If a fireman fails in an examination, how do you deal with him?

This subject is very closely connected with the economical operation of locomotives, and it is highly desirable that the committee should receive sufficient information to advise them of the practice followed on most railroads. Any information on the subject that a member may have, and which is not drawn out by the questions, will be gladly received by the committee.

Answers to be sent as soon as possible to W. H. Thomas, Superintendent of Motive Power, East Tennessee, Virginia & Georgia Railroad, Knoxville, Tenn.

Purification or Softening of Feed Water.

The committee to report at the next annual meeting of the Master Mechanics Association upon the best means of Purification or Softening of Feed Water, have issued the following circular:

1st. Have you had any experience with mechanical devices? If so, with what result?

2d. Have you tried chemicals, and with what result?

3d. Have you found practical, and do you recommend for use, any of the mechanical or chemical devices for purifying water? Please tell briefly what your experience has been with any method that you have tried, and also make any suggestions or recommendations that will be of use to the committee.

Replies to be sent to W. T. Small, 749 Dayton ave., St. Paul, Minn.

A patent has been taken out by a Californian for a coin-operating device for unlocking reversing car seats. With a device like this in use for lights, the use of the drinking cup, and the occupation of the toilet-room, the companies might possibly get along without asking fare. If some inventor will get up a device that requires the insertion of a four-hundred dollar bill before a farm hand, with a Buffalo overcoat, and two drinks of whisky, can open a car window in front of a woman with a sick baby, we will head a list of "eminent citizens" that will build him a monument nine hundred and eighty-four feet high.

Considerable time and trouble are expended on every cylinder made, to lay out, and mill out, the exhaust port exactly true with the other ports. There is absolutely no use in doing anything to the exhaust port more than to clean it out and get rid of the sand around the opening. Its being milled out true does no good at all; it is the steam port and edges of the valve that do all the admitting, cutting off and releasing the steam, the exhaust port is merely a hole, and a cast hole is just as good as a machined hole—and lots cheaper.

One of the new elevated engines being built at Baldwin's will have Swinerton wheels, with flat spots half an inch long. It is now claimed that some thoughtless person put the driver brake on and exterminated the flat spots on the last pair of wheels tried. This thing dies hard on the elevated. If good nursing will put life into it there may be some days elapse before the final funeral; but, seriously, why not make the wheels square? It is said the Wright design of four-cylinder compound will also be tried.

Adolphe Viart has recently been invested with the silver palms and violet ribbon of "Officier de l'Academie," the highest honor France can bestow upon artists and men of literary genius. This man has been for more than thirty years a wheel tapper and greaser on one of the French roads at Vernon, in Normandy. He wrote poetry at night, and was unknown until a man with money heard of him and helped him publish his verses. He is known now as "the greaser poet."

A committee of citizens are circulating a petition in Philadelphia, asking for a stringent ordinance against the use of soft coal as fuel on locomotives or motors run within the city limits.

None Too Soon.

General Manager H. S. Haines, of the Savannah, Florida & Western, has issued a circular to employes that concludes as follows:

To FLAGMEN: Never forget that you are placed at the rear of the train to protect life and property, and that it is in the darkness of night, in fogs and storms, that your prompt attention to duty is most valuable.

It is better for your own piece of mind that you should get wet or be left on the road cold and hungry, than for you to see life lost, perhaps your own friends mangled and crippled, or engines and cars broken up in a collision, through your own carelessness or laziness, or because you did not go back when you knew that you ought to.

To ENGINEERS AND CONDUCTORS: Your attention is called to this circular, see that your flagmen understand it and act upon it. Pay strict attention to giving whistle signals or verbal instructions to flagmen, also as to dropping fusees in ample time, when you know in advance that you intend to stop at an unusual place. You will thereby assist your officers in protecting your own lives, as well as the lives and property which it is your duty to protect. You will also add to the reputation of the railroad company which employs you, and in which, I believe, you take as much pride as I do.

Of the class of railroad accidents that can rightly be charged to negligence of employes, there is little doubt that fully ninety per cent. is due to insufficient flagging or to no flagging at all.

Pedrick & Ayer, of Philadelphia, have sent us a combined memorandum and pocket book—empty, as usual. This is the neatest and most expensive vest pocket book we have ever seen given away as an advertisement. It's a daisy.

John Hickey has resigned as General M. M. of the Milwaukee, Lake Shore & Western, to become superintendent of motive power of the Northern Pacific, Mr. W. T. Small having resigned.

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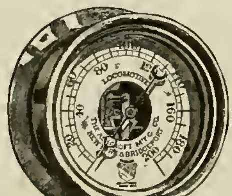

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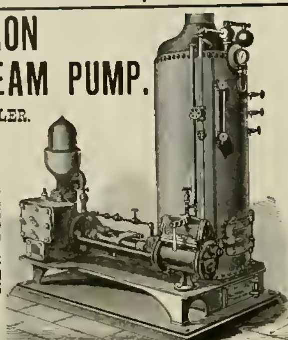

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IT WILL RE-START ITSELF

should the Jet break from interruption of the steam or water supply, as soon as the supply is resumed.

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to varying steam pressures without waste of water. Increases quantity of water with increase of steam, and vice versa.

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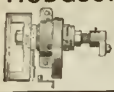

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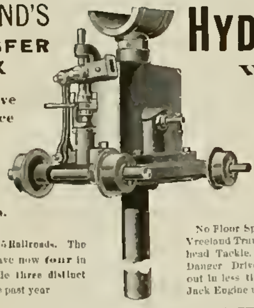

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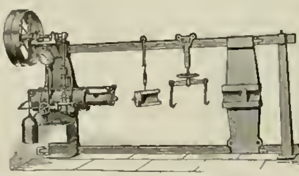

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Which is acknowledged by authorities and accorded the confidence of the manufacturers throughout the United States and foreign countries, is manufactured exclusively by G. W. Lord, practical chemist and inventor. Attention is called to other parties, who, through the appropriation of G. W. Lord's antiquated patent, have deluded many manufacturers into presenting them with their order for Lord's Boiler Compound. The use of the above formula, patented in 1869 by Mr. G. W. Lord, has been long discontinued by him, owing to his discovery of many new chemicals, which upon critical experiment have demonstrated their superiority. Lord's Boiler Compound, manufactured at the present time, is an article greatly superior to the formula patented by Mr. G. W. Lord. For decree of court, etc., address G. W. LORD, 830 Union Street, Philadelphia, Pa.

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LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 5. NEW YORK, MAY, 1891. $1.00 per Year or 10c. a copy.

Engines of the "Royal Blue"—The Fastest Train in America.

What is popularly known as "American conditions" has prevented the attainment of very high speed for very long distances, and, while some of the fastest time ever made for a few miles has been credited to American locomotives, the English have always run their express trains faster than we have

The fastest trains now running in America are the five-hour "Royal Blue" trains between New York and Washington, a distance of 227.6 miles, being run at an average speed of 45.5 miles per hour, but the conditions calling for more than 60 miles per hour for much of the way. These trains are run by the Central Railroad of New Jersey, the Philadelphia & Reading, and the Baltimore & Ohio, and run over portions of the three roads to reach the national capital from the greatest metropolis of the continent. Thirty-one miles, from New York to Bound Brook over the C. R. R. of N. J., sixty miles over the Reading from Bound Brook to Philadelphia, and the remainder over the B. & O., are the proportions of trackage operated by each road. The "conditions" to be met are extremely difficult for the attainment of high average speeds, and that these trains are so seldom late is a credit to the respective operating departments, and the engine and train men.

To begin with, the Central road has the ferry from New York to Jersey City—one mile, and across the crowded North River. This occupies twelve minutes from the time the five-hour time is commenced until the train is actually started from Jersey City.

The road is four-tracked, and protected with automatic block signals, but runs through many small places, not extra well protected, has a number of heavy curves, a drawbridge over Newark Bay over 10,000 feet long, a grade crossing of the P. R. R. at Elizabeth, and an undulating road with grades averaging from ten to forty feet per mile. The fastest trains always stop at Elizabeth for passengers, and at Plainfield on signal, and yet they are required to run the 30.1 miles in 36 minutes—52 miles per hour.

The Reading road is a double track, not protected by block signals. It is rather crooked in places, but has very slight grades. The fast trains stop at Trenton Junction, Jenkintown, and Girard avenue, make a circuitous entry into Philadelphia, and cover the intervening 60 miles in 73 minutes—50 miles per hour

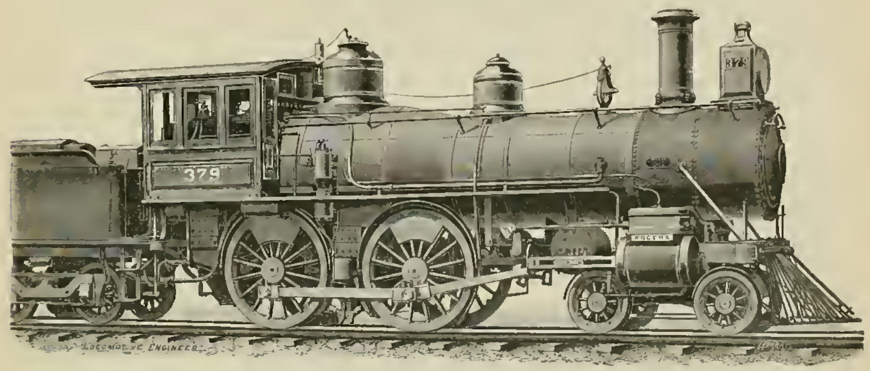
The B & O. road is double track, and comparatively new The track is good, but has numerous curves The road is hilly, the grades averaging about 20 feet, the heaviest being 42; but the Philadelphia division starts and stops at tide-water The trains always stop at Wilmington, and, on signal, at one other station At Havre de Grace they must run slowly over a 6,000-foot bridge. At Canton the engine and train are run upon a large transfer boat, and are ferried more than a mile across the river, when, for three miles, the train runs through yards and the streets of the city to the Baltimore station, into which it heads Another engine takes hold of it from behind and pulls it to Washington, 40 miles away, making one stop *en route*. The fast trains are taken over this piece of difficult road for a distance of 136 miles in 2 hours and 55 minutes, or at the average speed of 47 miles per hour.

So the reader can plainly see that to make this kind of time, including all stops, ferries and slow-downs to scoop water, etc., that all of the roads have to run the trains considerably more than a mile per minute between stations.

THE TRAINS

The "Royal Blue" trains are a step in the right direction toward the attainment of high speed. They are lighter than the usual trains on American railroads Only four cars are hauled on the fastest trains. They are two day coaches, one parlor car and a dining car, with a small baggage compartment in one end. The cars are painted "Royal Blue"—whatever shade that is—and on the sides, in the center of each, there is painted a large and handsome shield, showing the State arms of New Jersey, Pennsylvania, Delaware or Maryland—the States through which the trains are run, these trains are vestibuled throughout, and make a very handsome appearance.

The interior is finished in mahogany. All the cars are provided with a commodious smoking room and a wash-room for gentlemen, and a large toilet-room for ladies, just as sleeping cars are. They are lighted by the Pintsch system of gas lights, are steam-heated throughout, and a porter is provided for each car. In the day coaches the Hale & Kilburn seats are used, which are more comfortable, but not quite so elaborate as the pivoted sofa



ENGINES OF THE FASTEST TRAIN IN AMERICA

chairs in the parlor car—for the use of which a small extra charge is made.

The diner is somewhat smaller than those usually seen on long runs. They are elegant, however, and the service as good as the best. They have six tables, seating twenty-four persons. The kitchen is near the center of the car, and beyond it there is a short baggage compartment.

The coaches are 65 feet long, and weigh 70,000 pounds each. The parlor car is the same length, weighing 74,000 pounds, and the diner weighs 80,000, making the total weight of train 294,000 pounds. These trains were built by Pullman, and are the joint property of the three lines operating them.

THE LOCOMOTIVES.

Each road uses a different locomotive. All of them give good results, and doubtless the officers of each road think they have the best.

The engraving on the first page shows the class of locomotive used by the Central of New Jersey. They are typical American locomotives, originally designed by the Baldwin Locomotive Works, by whom the greater number have been built. The one shown was built by the Rogers Locomotive and Machine Works, at Paterson, N J. These engines are of the following general dimensions:

Cylinders, 19''x24''.
Diam. of drivers 78'', centers 62''.
Engine truck wheels 38'' diameter, Paige steel tired.
Tender truck wheels 36'' diameter, Paige steel tired.
Steam ports, 1⅝''x18''.
Exhaust ports, 3''x16''.
Bridges, 1¼''
Allen-Richardson valves, 5½'' travel, ⅞'' outside lap, 1/16'' inside lap.
Driving axles journals 7½''x8½'' (have been increased on later engines now building at Cooke's).
Engine truck axle journals 5½''x8''
Tender truck axle journals 5''x8''
Boiler, 56'' wagon top, ½'' steel plates, shallow fire-box for anthracite coal with grate of waters tubes and pull bars. Box 125'' long x42'' wide x53'' deep front x48'' deep back. Tube plate, ½'' crown; sides and back all ⅜'' steel. Crown bars, 230 flues 2'' outside diameter 144½'' long No. 13 w. g. Working pressure 145 lbs. per sq. in. Dry pipe, wrought-iron, 8'' outside diameter.

Weight on drivers	81,004
" " truck	28,856
" tender	77,050
Total weight	187,810 lbs.

Rigid wheel base, 7' 6''; total wheel base, 21' 8''. Tender fitted with water scoop.

The writer recently rode on one of these engines on the fastest train between Jersey City and Bound Brook. The yard limits were passed at a comparatively slow rate of speed. Three slow downs occurred, and two stops, yet the run was made on time. More than 10 miles out of the 31 were made at a speed of over one mile per minute, and on the straight track, slightly down grade, into Bound Brook, we made two consecutive miles in 51 seconds each—a speed of 70 miles per hour. This was the highest speed attained on the trip over the three roads. These engines burn anthracite coal, carry 145 pounds of steam, and hold their steam pretty good.

This run is so short that it is not necessary to take water, but enough coal is carried for two round trips. If the engines were stripped to do their best, a great deal of dead weight in fuel and water could be taken off.

Only three minutes are allowed at Bound Brook, Philadelphia and Baltimore to change engines, and the men are so spry that no delays occur on this account.

The train was pulled from Bound Brook to Philadelphia by a Wootten fire-box, eight-wheeler, built by Baldwins. These engines differ in form from ordinary engines only in the peculiar form of boiler, having a very wide fire-box, with the grates above the wheels. We did not get a chance to ride on this engine, but timed her over the whole division. She made exceptionally good time all the way, and between Langhorne and Philmont was only using 56 seconds to get over a mile of track—this is 64 miles per hour. She ran for many miles within a second of a mile per minute.

The B. & O. engines shown in our full-page supplement are the latest example of fast express engines in this country. They are large for the trains hauled, but it takes power to get high speeds. The introduction of 78-inch wheels was a step in the right direction. Probably no better or faster engines than these can be found on the continent. The following are the complete specifications furnished by the builders, the Baldwin Locomotive Works, Philadelphia, Pa.:

Class 8—34 C, 34 to 36.] [Drawing No. 4.

SPECIFICATION

No. 5,497.

Of a high-speed passenger locomotive engine, having two pairs of coupled wheels, and a four-wheeled center-bearing truck, for the Baltimore & Ohio Railroad Company

DIMENSIONS.

Cylinders, 20 inches diameter and 24 inches stroke.

Driving wheels, 78 inches diameter.

Gauge, 4 feet 8½ inches.

Fuel, soft coal and coke.

Total wheel base, 21 feet 11 inches.

Driving wheel base, 7 feet 6 inches.

Total wheel base of locomotive and tender, 46 feet 10 inches.

WEIGHT.

Weight in working order, total 116,000 pounds, on driving wheels, 76,000 pounds.

Weight of tender, with fuel and water, about 70,000 pounds.

BOILER.

Made throughout of flange plates of homogeneous cast-steel, ½ inch thick, riveted with ⅞ inch rivets, placed not over 3 inches from center to center, all longitudinal seams butt-jointed, with double covering strips. Throat sheet ⅝ inch thick. Throat sheet ⅛ of an inch thicker than shell of boiler, to prevent undue thinning where flanged. All parts well and thoroughly stayed, and extra pieces riveted to inside of side sheet, providing double thickness of metal for studs of expansion braces. All plates planed at edges, and calked with round-pointed calking tool, insuring plates against injury by chipping and calking with sharp-edged tools. Boiler tested with hot water to 180 pounds pressure per square inch, and by steam to at least 20 pounds above working pressure; working pressure, 140 pounds; waist, 58 inches in diameter at smoke-box end; made wagon top, and with one dome placed over wagon top; tubes, of iron, No 12 wire gauge, with copper ferrules on swaged ends in fire-box tube sheet, 251 in number, 2 inches in diameter, and 11 feet 10 inches in length.

Heating surface flues, 1,544 square feet.

Heating surface, fire-box, 143.45 square feet.

Total, 1,687.45 square feet.

Height to center of boiler, 8 feet 3½ inches.

Height to highest part of boiler, 11 feet 5⅝ inches.

Height to top of stack, 14 feet 8⅞ inches.

Fire box, 107¼ inches long, and 33⅝ inches wide inside. F., 67⅝ inches deep; B., 52⅝ inches deep; of homogeneous cast steel, all plate thoroughly annealed after flanging; side and back sheets, 5/16 inch thick, crown sheets, ⅜ inch thick; flue sheet, ½ inch thick, water space, 3 inches sides and back, 4 inches front; stay bolts, ⅞ inch diameter, screwed and riveted to sheet, and not over 4½ inches from center to center, sliding fire-door opening, formed by flanging and riveting together the inner and outer sheets; tool guard to be cast on lower part of fire-door frame. Fire-brick arch, with crown sheet, supported by crown bars, each made of two pieces of wrought-iron, 5½ inches by ⅝ inch, set 1¼ inches above crown, placed not over 4½ inches from center to center, and bearing on side sheets. Crown bar bolts, not over 4½ inches from center to center, screwed through crown sheet, with head on under side. Crown stayed by braces to dome and outside shell of boiler.

Cleaning plugs in corners of fire-box.

Balanced puppet throttle valve of cast-iron, in vertical arm of dry pipe.

Grates, rocking finger.

Ash-pan, with double dampers.

Straight pattern, steel base, smoke-stack.

Smoke-box, extended, with netting, deflecting plate and spark ejector. Nozzles, double, 3¼'' diameter.

FRAMES.

Of hammered iron, made in two sections.

Front rails bolted and keyed to main frames, and with front and back lugs forged on for cylinder connections.

Pedestals forged solid with main frames, and protected from wear of boxes by cast-iron gibs and wedges. Pedestal cap lugged and bolted to bottom of pedestals.

ENGINE TRUCK.

Center bearing swiveling, four-wheeled truck. Truck frame of wrought or cast-iron, with braces of wrought iron; fitted with fixed center bearing

Four cast-iron center, steel-tired wheels, 36 inches diameter.

Axles of hammered iron, with journals 5 inches diameter and 10 inches long.

Springs of crucible cast-steel, tempered in oil, connected by equalizing beams resting on top of boxes.

MACHINERY.

Of close-grained iron, as hard as can be worked, each cylinder cast in one piece, with half saddle, placed horizontally; right and left-hand cylinders reversible and interchangeable, accurately planed, fitted and bolted together in the most approved manner. Valve face and steam chest seat raised above face of cylinder to allow for wear. Steam ports, 19x1⅝ inches; exhaust ports, 19x2¾ inches; bridges, 1¼ inches. Cylinders oiled by Detroit sight-feed lubricator, placed in cab, and connected to steam chests by copper pipes running under jacket. Pipes proved to 200 pounds pressure.

Two Sellers re-starting injectors, No. 10.

U. S. metallic packing for piston rod and valve stems.

Pistons of cast-iron, fitted with approved form of steam packing.

Piston rods of iron or steel, ground and keyed to crossheads, and securely fastened to pistons.

Guides, double bar style, of steel, fitted to wrought-iron guide yoke.

Crossheads of cast-steel, with brass bearings.

Shifting-link motion, links, sliding blocks, pins, lifting links, and eccentric rod jaws made of hammered iron, well case-hardened; sliding blocks, with long flanges, to give ample wearing surface; rock shaft of wrought-iron; reverse shaft of wrought-iron; slide valves, Morse balanced, with vacuum valves.

Driving wheels, four in number, 78 inches in diameter; centers of cast-iron, turned to 72 inches diameter.

Tires of cast-steel, 3 inches thick when finished; back pair flanged, 5⅝ inches wide; front pair plain, 7¼ inches wide.

Axles of hammered iron; journals, 8 inches diameter and 9½ inches long.

Driving-boxes of cast-iron, with brass bearings.

Springs of crucible cast steel, tempered in oil.

Equalizing beams of wrought-iron.

Connecting and parallel rods of steel or hammered iron. Connecting rods forged solid. Parallel rods with solid ends and heavy brass bushings. Bushings put in by hydraulic press, and well secured from turning in rod.

Lubrication of all bearings carefully provided for, and oil-cups attached where required.

Adjustable needle oil-cups on rods and guides

Wrist-pins of wrought-iron.

Feed water supplied by two 10½ Sellers 1887 injectors.

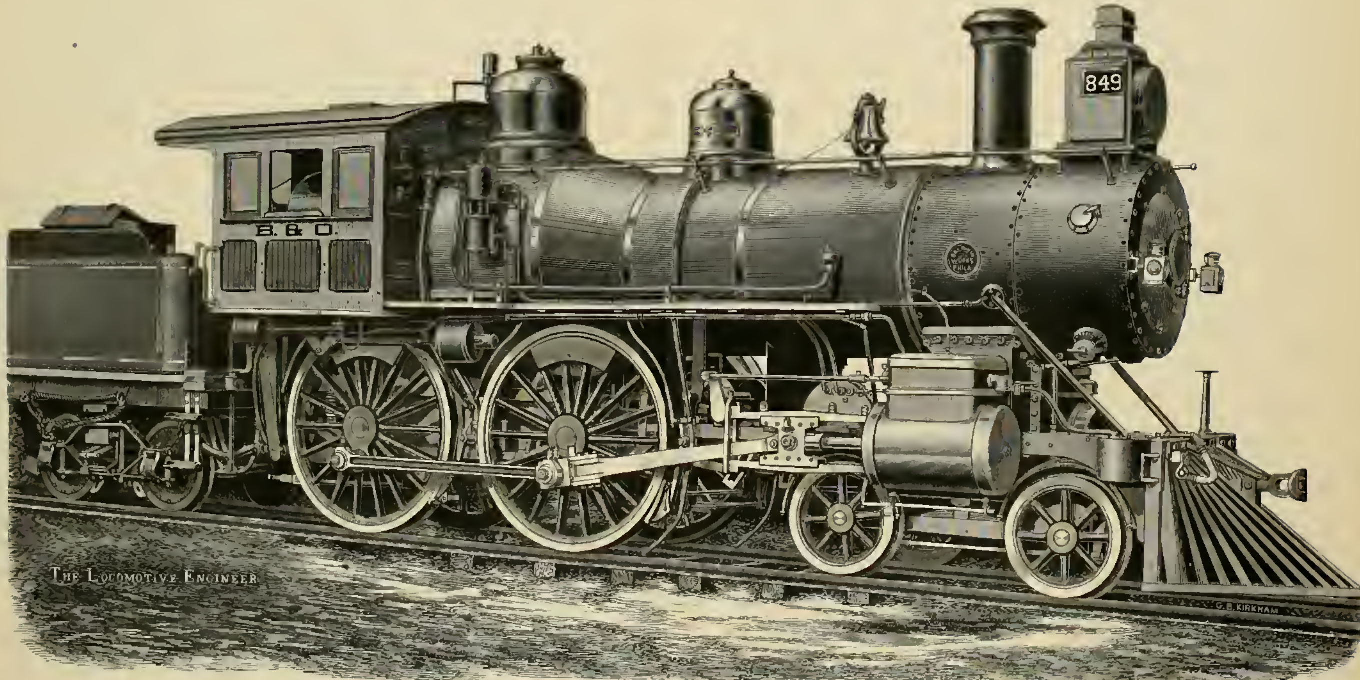
ACCESSORIES.

Cab with ventilator, substantially built of clear, yellow pine, well finished, and fitted together with joint-bolts and corner plates. To be provided with suitable windows and doors, conveniently arranged, and glazed with first-quality double American crystal glass.

Pilot of wood braced with iron, with wrought-iron bull nose.

TOOLS.

Engine to be furnished with one 28 sand-box, stand for head-lamp, bell, whistle, blow off cock, blower and two 3'' Crosby safety-valves, steam gauge, cab lamp, gauge cocks; also a complete set of tools, consisting of two heavy jack-screws and levers, one heavy pinch bar with steel point and heel, complete set of wrenches to fit all nuts and bolts on engine, including two monkey-wrenches, one set of driving-box packing-tools, one machinist's hammer, one soft hammer, three cold chisels (two flat and one cape), one long-spout quart oil-can, one two-gallon oil-can, one tallow-pot, one torch, engineer's arm-rest, one extra fusible plug, one bell cord, cab seats, cab seat cushions, one



LOCOMOTIVE OF THE "ROYAL BLUE"—THE FASTEST TRAIN IN AMERICA.

DESIGNED BY THE BALDWIN LOCOMOTIVE WORKS.
PHILADELPHIA, PA.

poker, one scraper, one slice bar, and one scoop shovel.

Headlight to be furnished by R B Co.

Westinghouse automatic brake, applying to forward side of each driving wheel, and to tender wheels. Westinghouse train signal

FINISH.

Cylinders lagged with wood and neatly cased with iron, painted. Cylinder head covers of hydraulic-forged steel, polished. Steam chests with cast-iron tops ; bodies cased with iron, painted. Dome lagged with wood, with iron, painted, casing on body and cast-iron top and bottom rings.

Hand-rails of iron. Running board nosings of angle iron. Wheel cover nosings of iron. Boiler lagged with wood, neatly jacketed, and secured by iron bands.

GENERAL FEATURES OF CONSTRUCTION

All principal parts of engine accurately fitted to gauges and templates, and thoroughly interchangeable.

All finished movable nuts and all wearing surfaces of machinery made of steel, or iron case-hardened.

All wearing brasses made of phosphor bronze or ingot copper and tin, alloyed in proportion to give best mixture for wearing bearings.

All threads on bolts to United States standard.

TENDER.

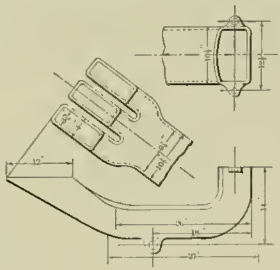
Provided with water scoop and Janney coupler. Tank of steel or iron, strongly put together, with angle-iron corners and well braced Top, inside, and bottom plates ¼" thick, outside plates $\frac{3}{16}$" thick, riveted with three-eighths inch rivets, one and one-quarter inches pitch Capacity 3,500 gallons (of 231 cubic inches).

Shape of tank, U-square top.

box end of the tubes, which must be scraped off.

One of the best recommendations of these engines is that the men like them; they all say that they ride well, steam well and can "get there" The only criticism from an engineman that we heard, and it seems a reasonable one, was that the roof of the cab was six or eight inches too low for comfort and a good lookout, but the height at the eaves is regulated, we understand, by the size of some tunnels on the line; the center, however, could easily be raised.

The using of a bald tire ahead is done to conform to the ideas of those in authority on the road, and not those of the builders; there is little doubt that the engine would be safer, easier on the track and on herself with flanged tires on the forward drivers. These engines have repeatedly made the run from Washington to Baltimore, 40 miles, in thirty-nine minutes, and have made up fourteen



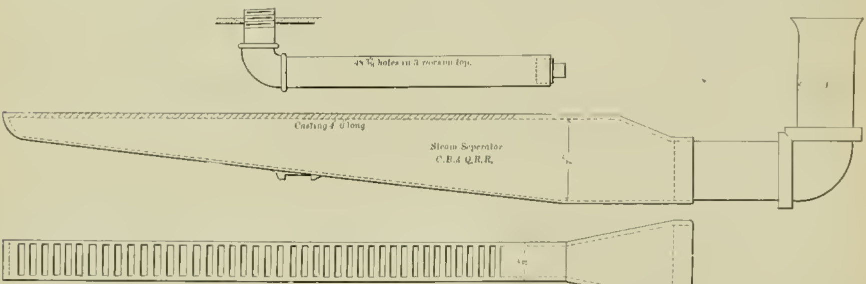
equal of an ocean steamer for convenience and elegance, a veritable traveling palace hotel—the "Royal Blue" aims more to comfort and cleanliness, a light train, powerful engines and fast time, and it is to be hoped is but the beginning of a regular move in this direction by many of our roads running between large cities.

To our friends abroad who are inclined to pick up all odd or outlandish forms of experimental locomotives made in this country, and criticise them as typical American engines, we can say the B. & O engine shown herewith is the latest and best form of American express locomotives built and operated in this country.

Curious Devices to Put into Locomotive Boilers.

Much that is interesting, amusing and instructive has been given to the world by men who have made a study of the peculiarities of different species of animals, birds, reptiles, insects or plants—when man knows what a certain animal or plant or element will do under certain circumstances he can figure intelligently on the outcome of any plans he has that deal with the subject or thing the habits of which are known—if he is in the dark on the subject he is liable to make several grotesque devices or expensive mistakes before he finds out which way the animal will jump when approached.

It has occurred to us that some student of nature, art or science might do a good thing by giving us something on the habits and peculiarity of steam. What is it, anyhow? Does it swim or fly? Is it hot or cold? Can it be tamed and taught to do tricks? Can it be taught to crawl through a gimlet hole, and to dodge the bore of an auger? How does it produce and rear its young? What will make it



CURIOUS DEVICES FOR BOILERS.

Tender frame substantially built of oak, strongly braced.

Two four-wheeled center-bearing trucks, made with wrought-iron side-bars and two cross-beams of wood or channel iron; additional bearings at sides of back truck Springs, crucible cast-steel, tempered in oil.

Boies steel tired wheels thirty-six inches diameter. Brakes on both trucks.

Axles of hammered iron or steel ; outside journals 3¾ inches diameter and seven inches long Oil-tight boxes with brass bearings.

We have published the complete specifications of this engine because it will be interesting to preserve with the engraving, and serve to explain it.

On our trip over the B. & O this engine made many miles above the rate of sixty miles per hour, and in one instance covered two miles in one minute and forty-eight seconds—66 miles per hour.

These engines burn coke with a slight mixture of soft coal to insure its quickly kindling, about one ton of soft coal is taken in the bottom of tender and the tank then filled with coke, the fireman using the coal when and where needed. This fuel burns nicely, emitting no smoke, and giving off only a light dust, thus by the two first roads using hard coal and this one coke the trains are kept clean and comfortable. To burn coke the brick arch had to be abandoned, as the coke has a endency to form a light, crusty clinker on the fire-

minutes on the run between Washington and Philadelphia.

The writer examined the train sheet on this division and found a detailed report of every minute's delay to the "Royal Blue" trains for a full month, and there was not a minute charged to these engines for any cause—this is remarkable service

None of the roads mentioned keep a very close record of fuel; to be sure so many buckets, or cars, or chutes are charged up to the engines, but at best it is guesswork, so that any figures given from the general fuel account would be misleading one way or the other—the men on the B & O. say that the new engines are the most economical machines in the service, and that they are capable of handling the present trains in twenty minutes better time than they do.

The worst feature in the Central of N J. engines is a small driving-box, they heat pretty regularly and all the fast engines have water pipes that throw a small stream of water on each box all the time the engine is running. The B & O.'s have an inch longer box and don't turn the axle in it so many times in a mile, and give no trouble from heating.

The introduction of the "Royal Blue" trains is the first reasonable move made in America toward faster travel. The American ideal seems to have been for extra comfort, elegance and weight for the best trains—the Pennsylvania Limited is the

weak and tired, and what will kill it? This last is the most important question.

Perhaps if something definite were known of its habits there would be more concerted action in the attempt to catch, tame and train it for useful work, instead of so much indiscriminate killing just for the hide and tallow.

Some of the latest steam traps are shown herewith; they have peculiar functions to perform, or else C., B & Q. steam has peculiar habits. The device shown is called a "steam separator"—not a threshing machine—and there are a pair of them in each new boiler put on that road. They are about eight feet long, over all, and are supported in the boiler by heavy loops of strap-iron from the top of shell; they have forty-two slits in their top, each slit being one-quarter of an inch wide and 2⅜" long; these are cast in, and are on an angle, as shown. These are put in the boiler so that this angle slotted water goose extends back over the crown sheet, and the open pipe at the other end extends up into the dome. The form shown is that used for engines with Belpaire fire-box where the wagon top is slightly higher than the barrel of boiler, where dome is located, and this goose is supposed to carry the live steam around to keep the throttle valve dry and happy.

Another breed of the same species with a perfectly straight top are used in straight boilers—it's curious that steam won't go along the top of the boiler to the dome, and will crawl through a sifter and up a pipe to the same place.

There is a theory about the impinging of the wet steam upon the south sides of those angled slots, and the slipping up and falling back into the boiler of the wet part, and the escape of dry and dusty steam to the dome, but we are not capable of understanding it. At the base of the dome there is an iron plate ⅜ thick, made in halves and punctured copiously with ⅛ holes, we are unable to state the exact use of this screen door, it may be to prevent the escape of the dry steam from the separator, or to prevent wet and low caste steam from coming up from the slums and mixing with the pure, refined article—probably the latter.

New engines of the C., B. & Q. also have a steam catcher, shown in Fig. 2, to supply steam to the fountain in the cab, this is simply a piece of pipe drilled at the top with forty-eight small holes; this device has some merit, but takes steam lower in the boiler than would a direct connection, and will, in all probability, be as bad if the water in boiler surges badly in quick stops; when there is no steam being used through the cab cocks, this pipe will fill with water, and go where it can do no good, and may do harm, through the first cock that is opened. We are unable to see—from our meager knowledge of the habits of steam—why each of these enormous watering troughs will not fill with water when the engine is at rest, only to be thrown out at the top of the dome when a current is established. It would seem to a layman that if some of these instruments of torture were removed, that reasonably dry steam could be induced to crawl along the upper part of the boiler—like a fly—and enter the dome of its own free will and accord.

It is improbable that it is the intention to carry water so high in these boilers that there will be no steam room between it and the top of the shell. If the dome of these boilers was removed altogether, and these two steam driers could be run tandem, and were connected direct to the dry pipe, and the throttle placed in it, far drier steam could be furnished than that now dried in the separator, and delivered to the hatchery—the dome.

The closer the steam can be kept to the fire, and in contact with the circulating water, the hotter and drier it will be.

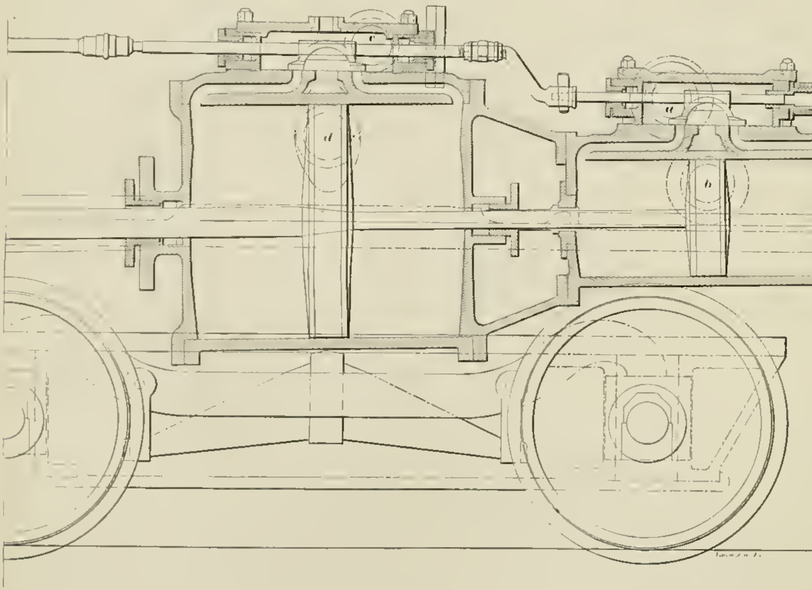
The upper figure shows a device used on the great Pennsylvania's new Belpaire boilers. It is called the "trap for sewer gas" by the men, and is a sort of a Black Maria for conveying to the proper asylum demented, imbecile or idiotic steam that don't know enough to come in out of the wet when it has all the chance in the world.

Schemes like these have been tried for years, and will be tried for years to come, and we really think something on the habits of steam during its spawning season would not be amiss.

The First Compound Locomotive in America.

Since the compound system for locomotives has been forced upon the attention of the railway mechanics of the world, there has been more or less of a rivalry among certain inventors to be known as the originators of the system, and not a few have contended for the distinction of building the first in America.

We believe that the engravings shown herewith, from the original drawings, represent the really first in America, and, perhaps, in the world, and this was no odd or obsolete design, but a mechanical affair, and one that has some advantages over any other compound yet built; moreover, this compound locomotive was in actual service for some years.



The first compound marine engines used in this country were designed and built at the Shepard Iron Works, Buffalo, N. Y., for the propeller "Susquehanna," which at once showed such results that many other boats had their engines rebuilt to compounds, and all the new power was of that pattern. At that time Mr. E. M. Ketchum was draftsman for these works, he made the drawings for the first compound marine engine, and also has the distinction of planning the first compound locomotive.

Mr. Ketchum is now employed in the custom house, at Buffalo, and has many of the original drawings of compound engines, and was so kind as to loan the original locomotive drawing, from which these cuts were made. The plans were drawn in 1866, and early in 1867 the Erie Railroad Company sent a yard engine to the Shepard Iron Works to be changed into a compound. The cylinders were taken off, and two new ones substituted on each side, making a tandem compound.

The high-pressure cylinder was fast to the head of the low-pressure cylinder, and also, by a side flange, to the frame, the piston rod was extended into it, and, by an ingenious device shown plainly in the cut, one gland was made to pack the piston rod in both cylinders.

The valve stem was extended beyond the yoke, and through the front of the chest, and by an offset connection drove the forward valve, the high-pressure cylinders are 12x24, the low-pressure cylinders being 24x24.

This plan admitted of the changing of old locomotives without disturbing their valve gear, cross-heads, rods or any other part except cylinders and saddles.

The plan view shows the arrangement of the pipes; steam was taken from the steam pipe in front end by pipe *a* direct to side of chest, as shown at *a* in sectional view, and was conducted from exhaust passage *b* through pipe *b* (in plan) to the chest of the low-pressure cylinder, the exhaust from the low pressure cylinder escaping through the regular nozzle. With this plan the work on each side of the engine was exactly the same; the breaking of one chest or one cylinder did not call for the throwing away of the others on that side, and no receiver was required.

This engine ran for about two years in the yard at Buffalo, and went from there to Hornellsville, where she did further service, but was finally broken up. We are unable to find that any record of this engine's work was kept, and little, or no experimenting was done to determine what her comparative fuel consumption was.

The locomotive was at a standstill just at that time, and the compound principle was not understood; on the road it was simply "a new contraption to make extra trouble." The designer and his engine were ahead of the age, and had to wait; the compound locomotive was a long time getting here, but she has come to stay.

A locomotive built on this plan to-day would be far from a bad design, and would have some advantages over any compound now built in this country.

The original patents, eight in number, were granted to Perry and Lay, in 1867.

The Canadian Pacific recently received dispatches that the "Empress of India," the first steamer of the road sent on the round-the-world trip, had arrived on exact time at Hong Kong. The vessel remains at that port two weeks, and then starts on the last lap of the journey for Vancouver. The "Empress of Japan" sails from Liverpool April 11th.

Steam Jacketing.

A correspondent who, some time ago, sent us a plan for a compound locomotive for our opinion on its merits, writes

* * * "As you will remember, I had an internal high-pressure cylinder, surrounded by the low-pressure cylinder, with a space like a steam jacket, having a low pressure piston in form of a ring. You thought I did wrong in blanketing my high pressure cylinder with exhaust steam. I have been looking over cut of triple expansion Corliss engine in *Power*. His engine is steam-jacketed over heads and barrels of cylinders, and the steam passes *through the jacket to the cylinders*. It looks to me like a worse case than mine would be for condensation, and, to judge from the loss of temperature in contact with so many surfaces, there was not much left for the pistons—yet the engine showed up 1,000 horse-power."

The stationary engine referred to, by making the jacket on the cylinder virtually part of the steam pipe, maintain the temperature of the cylinder the same inside and out, while our correspondent proposal to put live steam into his high-pressure cylinder, the outside being in direct contact with exhaust steam of a much lower temperature, there would be a constant loss of heat

The advantages or disadvantages of steam jacketing, in every form and shape, is very much in the dark, and no very exact knowledge exists on the subject In one instance it shows apparent economy, while in another it shows loss But, for obvious reasons, in no case can economy be attained by the use of steam in jackets of a lower temperature than that used in the cylinders.

Cover the Slot.

Where a valve rod is very short, as on ten-wheelers, with long eccentric blades, a knuckle joint is objectionable, and will soon wear badly, it is, moreover, little better than a stiff rod, as far as its wearing the packing is concerned A great many engines are built with slotted boss on the valve rod, in which a box on the end of the rocker works, the rod having a bearing on the yoke back of the rocker connection

Where such a construction is resorted to, the flanges of the box should be so deep as to entirely cover the slot in the rod in all positions This will keep out dirt and cinders, and prevent the careless leaving of wrenches, nuts, or packing hooks in the convenient slot, to say nothing of the security of fingers in case the reverse lever was moved while some one was wiping in the vicinity of the slot

Norfolk & Western Ideas.

On some heavy engines recently turned out of the Rogers Works for the Norfolk & Western they use a reverse lever whose latch engages with a screw instead of the common sector or quadrant; the lower end of the lever is slotted to admit of the lever rising and falling slightly, the screw being straight. The lever can be handled the same as a plain lever, and the runner can also adjust the point of cut-off by the screw, which is operated by a hand-wheel on the back end.

These engines have two blower valves, one each side of the boiler head, and the cylinder oil-cups are located one on each side, this is a bad cab arrangement; an extended handle would have made the blower accessible to the engineer without putting in an extra valve, and it would be far better to put the two oil cups together, as it is entirely unnecessary for both men to oil valves at one time, taking their attention from their work, the fireman can oil two almost as easy as one, and the engineer ought to have his attention on the tracks and signals or his brake These engines have the Belpaire boiler, and ahead of the cab on the flat wagon top the angle valves to the injector steam pipes are located—the injectors being located near the side of wagon top—but these valves are connected to the opposite injectors, the right-hand valve supplying the left injector, and the left valve the right injector, this calls for a big cross of crooked copper pipes on the top of the fire-box without any apparent good to come of it

Going Up.

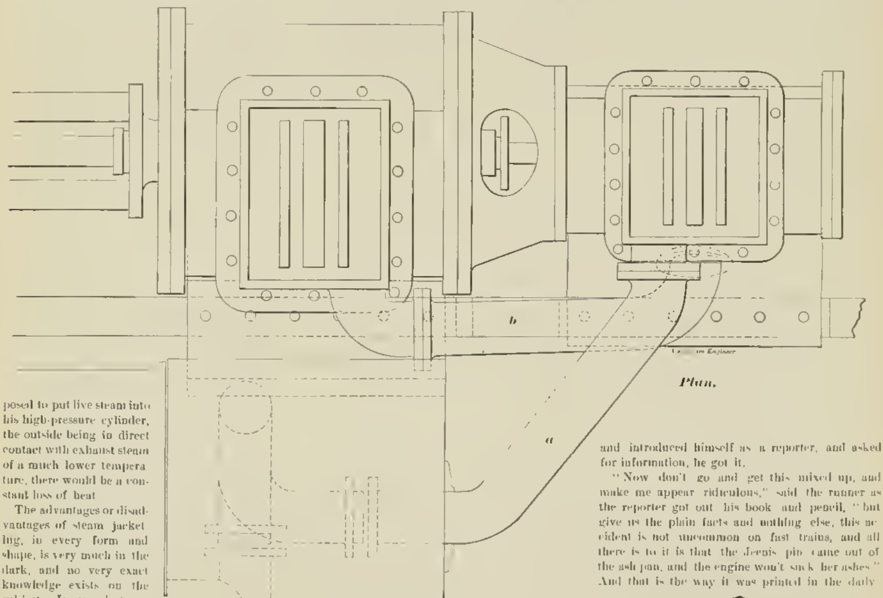
Joseph Billingham, traveling engineer of the Gulf, Colorado & Santa Fe road, has been promoted to the position of master mechanic at Temple, Texas. Bro. Billingham is a practical runner, and a member of the Brotherhood Engineer James McDonough, who represented his division at the Pittsburgh convention last fall, has been made travelling engineer to fill the place left open by Mr. Billingham. Of this appointment General Master Mechanic Ward says in his bulletin

His duties will be to inspect and report the condition of all engines, to examine the methods of firing, and instruct firemen in their duties concerning the consumption of coal, oil and waste, etc He will see that engines and tenders are kept clean, and that tools and small stores are in their proper places; in fact, he will have general supervision while on an engine, and his instructions will be respected and obeyed by engineers and firemen He is authorized to inspect all engine houses, and require the same kept in good condition, and the surroundings neat and clean. He will receive his instructions from the master mechanic, and report all cases of neglect or extravagance to the master mechanic or the division master mechanic Foremen of engine houses, engineers, and all concerned are requested to render all the assistance in their power to enable him to carry out his instructions

A Bad Breakdown.

Not long ago a Pennsylvania engineer had to stop on the road and disconnect his engine, and, of course, the passengers crowded around to see what was the matter This particular engineer had been cured of the chills by reading daily paper reports of accidents and railroad happenings, and felt grateful to the average reporter for the fun so unconsciously given. So when a young man came up and introduced himself as a reporter, and asked for information, he got it.

"Now don't go and get this mixed up, and make me appear ridiculous," said the runner as the reporter got out his book and pencil, "but give us the plain facts and nothing else, this accident is not uncommon on fast trains, and all there is to it is that the Jenuis pin came out of the ash pan, and the engine won't suck her ashes" And that is the way it was printed in the daily



FIRST COMPOUND IN AMERICA

Some Truth About War.

The slightest international question that arises is made the basis for a talk about war Many men are foolish enough to express the opinion that a war would be a "good thing" It would make business lively. Does the thinking citizen realize that for all the "lively business" he or his posterity must pay for with a heavy interest? Only a fool or a knave would wish for a war The money loaners of the world are the ones who profit by war The ruling classes make war an aid in suppressing the masses As long as they are able to create wars, they are safe from the democratic masses

What the masses of England, Germany and the United States have the most to fear in the future is that the moneyed aristocracy will plunge them into a war that will check or destroy the advance they have made in their own emancipation It will be the last desperate resort to stem the tendencies of the age. Workingmen should never let the patriotic cry blind them from looking below the surface and learn why it is necessary The aristocracies of the world would gladly bring on war, that their position might be more secure Compel them to do the fighting and there would be no war.—*U P Employes Magazine.*

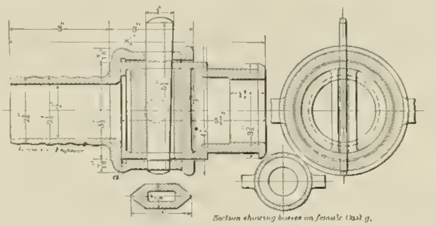
Standard Hose and Feed Pipe Coupling of the Norfolk & Western.

The accompanying engraving makes plain the details of one of the simplest and best water hose connections we have seen.

The usual threaded form with rubber gasket, cone strainer and coal pick brands on its ears, is familiar, and shortcomings well known. It is hard to keep tight, and a mean thing to work at when in a hurry or in snow

The coupling here shown is very simple, and is very quickly and easily opened and closed, requires no gasket, and there are no threads to cross.

As will be seen, the female casting is smooth, with two slots through it for a key, and has bosses to facilitate getting it off or turning to match the keyway. The male casting has a rib across it through which a keyway is made; this keyway, of course, does not open to the water space. When the hose coupling is shoved over the male casting, which is screwed to the feed pipe on the engine, a joint is made at *a*, and the key is dropped into the keyway, and, being of slight taper, a light tap with a hammer secures it against possibility of jarring loose. The key is easily loosened by a tap of the hammer from underneath, and the coupling pulled apart.



Standard Hose and Feed Pipe Coupling.

This device has been in use for some years on the Norfolk & Western, with satisfactory results

How to Prevent Streaking of Dome Casing and Jackets.

To any one who has any pride at all, be he fireman, engineer or master mechanic, it is always a source of annoyance to see a new dome casing or boiler jacket streaked up with some compound from inside, that runs from the seams down, and in Russia iron generally takes the finish off and leaves a white streak.

Jackets are almost invariably put on so that the lap is from the top, the upper sheet outside, like shingles. This is to make it shed water from the outside, but rain never does harm—it is all done by moisture from within.

If a boiler seam leaks it is worse, but if there is no leak there will be some moisture sweat out of the lagging, and this is charged with some substance that cuts the planished surface of Russia iron like acid.

A little hot water running down outside a dome casing cuts off a strip of paint like a knife.

All this trouble can be avoided by putting the jacket and casings on right The upper sheet of a jacket should always lap *under*; this will conduct all the moisture, acid, etc., to the bottom, where a few holes should be punched for its escape.

This plan of lapping jackets was in use years ago by the R. I. Locomotive Works and their jackets so made never streaked up.

The side sheet or band of dome and sand-box casings should go *outside* an internal lip on the cover or top, and *inside* the base casting.

Any master mechanic who will take the trouble to try this plan will be gratified at the results, and the firemen and engineers will rise up and call him blessed.

The streaking not only looks badly, but causes lots of unnecessary work.

The Serve's Ribbed Tube.

The accompanying illustration shows a cross section of actual size of a form of tube invented by a French engineer, and now in use in the boilers of some forty locomotives on the Paris, Lyons & Mediterranean Railroad, and also in several lines of river steamers in France; they are also being tested on the Metropolitan Railway of London.

Elaborate tests of the efficiency of these tubes have been made by the French Admiralty, and far better results claimed than can be had with plain tubes

This form of tube is much stronger to resist crushing strains, and the plain part or outside of the tube can be made thinner, the ribs absorb a very great quantity of heat, and convey it through the exterior to the water.

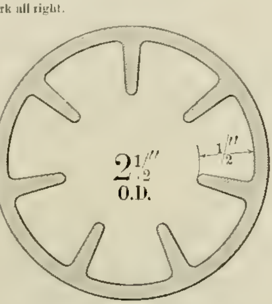
At first sight one would think that these ribs would get red-hot and burn out, but experience has proven that they do not.

To test this point, the manufacturers covered a steel tube, inside and outside, with an alloy of tin and antimony. They then surrounded this tube with a larger plain one, allowing but three-quarter inch water space between the two. A strong blast was kept going an entire day through the ribbed tube horizontally, the flame jet projecting three feet beyond the ends. Upon examination after the experiment, it was found that the heat had made no impression on the alloy, the melting point of which is far below the degree of heat necessary to produce a visible red on iron or steel.

This size, 2½", is the smallest size made in steel or iron; all sizes are made in copper and brass.

It is claimed that these tubes make extraordinarily strong hollow stay bolts. When used for this purpose the ends are thickened so as to admit of their being threaded. When used for flues the ribs are removed for three inches from the ends, to admit of expanding.

The manufacturers claim that no difficulty occurs in keeping these tubes clean with the ordinary appliance. Of course any blower flue cleaner would work all right.



The Serve's Ribbed Tube.

These tubes are made in Liverpool, England, and sold in this country by Charles W. Whitney, 81 Fulton street, this city.

We have in our possession a curious railroad ticket. It is in the shape of a two-dollar bill, and looks like one, having the regulation green back. The face reads: "The South Carolina Railroad Company. Fare Ticket. Good for the fare of two passengers twenty-five miles. Charleston, July 1st., 1873." It was engraved by the American Bank Note Company, and is a very nice piece of work. They have only been out of use for a few years.

The Pennsylvania engineer who rode at the head of General Sherman's funeral train, rode—or walked—behind the General in his march to the sea—"Endurin' de wah."

Correspondence

Why Emergency Valves Stick Open.

Editor The Locomotive Engineer:

Regarding the continuous flow of air to the exhaust in the quick-action triple valve or pressure-retaining valve when used, would say, the usual cause of this trouble is owing to the rubber-seated emergency valve being held unseated by cinders or other foreign matter. As a rule, obstructions of this character can be removed by giving the quick-action movement.

The most prolific source of cinder, sand, etc., in the triple, is owing to accumulations in the hose couplings as the result of the hose being left hanging down, and very much of this annoyance of leaking triples can be obviated if the hose were hung in the dummy coupling when not in use.

Chicago, Ill. K.

[A quick-action triple valve without a good strainer at train pipe connection is not complete and safe for service.]

The "Eddy Clocks"—"Practice" Tells Some Facts About Them.

Editor The Locomotive Engineer:

"Indicator" appears to be anxious to *learn something* about the "Eddy clocks," which goes to show that he is not entirely lost to the good things of this world. Will give him a few points that may do him good. For the past forty years the maker of these engines has been known to the railroad world as "Old Eddy," and the amount of *slurs* about him and his engines are "legion," and there were many who desired to show him and his employes how far behind the times they were, but the "unlucky" ones who met him on the "field of honor" with their "new-fangled notions" wish they had not.

About 1866 an M. M., who had lived near where the "clocks" were made, and whose engines came into close contact with them, became superintendent of the "Grant Locomotive Works," and it has been asserted that he did not enjoy a full night's sleep until they had secured an order to build some *fast* express engines to compete with the above "clocks." The old engineers who had always run the Eddy engines were so enthused over the new engines that they could hardly wait for their arrival.

They finally came, bringing a "streak of blow" of what they were going to do, and how sorry they were to hurt the "Old Man's" feelings, but it was their duty.

These engines were all that "Indicator" could wish, as far as theory and hand-books were concerned. Their dimensions were as follows: Cylinders, 16x24, wheels, 5½ feet, steam ports, 16 inches long, 1¼ wide, valve travel, 6 inches, and they were not loaded down with cast-iron cannon, but had a real dome all covered with brass, cylinders and steam chests ditto. In fact, they were the ideal locomotive for heavy fast passenger service, and were the envy of all engineers until they were put to work, and then their ability to perform the work required was found wanting.

A complete failure, as every knows who was in any way connected with the B. & A. R. R. at that time.

Mr. Eddy's nerves stood this shock much better than had been expected by such persons as think that a railroad company can haul their trains over the road with an indicator, assisted with a few hand-books of the locomotive in case of breakdown.

For some years the Eddy clock was allowed to tick along in its usual way, and when any one did slur them it was at low breath. But the best will sometimes forget, and when the Mogul "mania" became epidemic around Boston there appeared another chance to down the aforesaid "clocks" and their designer. After straining several brains to their utmost, the engine "Brighton" was brought forth. "A Mogul, the coming engine," which would reduce the cost of hauling freight wonderfully, on account of reducing the number of trains, etc.

At this time the clocks for freight service had 16 x26 cylinders with 5 foot wheel, four wheels connected, which was considered by the friends of the Mogul to be only a waste of money for freight use. The "Brighton" was to pull 50 per cent. more cars without any additional cost, either in fuel or labor. But when this Mogul got over to Pittsfield it was found that 13 cars up the hill to Dalton (8 miles) in 50 minutes was the best it could do, and that one of the Eddy freight engines could haul 14 cars up the same hill in less time, which was doubted by some of the "Mogul's" friends.

At this stage of the game the old man had a new passenger engine ready to turn out of the shop (the same as the one shown in your paper), and he took it over to Pittsfield to see what it would do pulling freight up the hill where the Mogul was working. This engine (the "Sacramento") was new, and he thought this a good chance to limber it up. It was coupled to 14 cars and went up the hill with them in thirty minutes, which was considered satisfactory by Mr. Eddy.

The Brighton was to haul thirty cars from Albany to Pittsfield, but was found to be only able to haul seventeen. After much figuring and theorizing according to the "Mogul" mania, it was found out that it was not the number of wheels that a locomotive had that did the work, but that the cylinders and boilers had a part to perform in getting the trains over the road. After this important discovery was made the Mogul's friends had some new engines made with larger cylinders and smaller wheels (same as the Brown), and were sure *that* was what would drive the Eddy engines off the railroad, not thinking it was possible to make a *larger* clock than was up to this time in use. But they reckoned without their host, as one can see by your article about that trial. Up to this time the fight was all one-sided, and would have continued so if a break-down had not occurred, which proved what an old 16x26 cylinder, 5-foot wheel clock could do on passenger train.

When the "Young Owl" train was put on, in the '70s, its time from Albany to Pittsfield was one hour and thirty-nine minutes, but it had never been made by any engine that they had tried on it. They had the Masons, the Grants, etc., which had never lost less than three minutes on the run; but when the regular engine gave out one night they coupled on the old Mississippi (a freight engine), which ran the train over in one hour and thirty-four minutes, this set some of the theorists to figuring once more.

Now "Indicator" wants to know why these engines are not still being made, and why steam ports of same size are not used at present, etc., etc.

Will say that it takes a much smarter man to answer a question than to ask it, and before trying to answer his question will ask one or two.

Why do ladies wear a large bird-cage on their back, called a bustle? why wear high-heeled shoes and a hundred other nonsensical things? I will tell you in one word, and that is—fashion, just fashion.

There were many good points about the Eddy clock that you did not mention in your article, and will give you a few of them. They were made with an independent valve seat which could be taken up when the chest was taken off, placed upon a planer to be faced the same as the valve, and required no hand-work. The frames were bolted solid to boiler, which prevented the necessity of repairing expansion braces with new bolts, etc., every time engine went into the shop. Their driving springs were arranged so they didn't "gouge" into the boiler all of the time, and they could be put in and taken out much easier than any other style yet seen. The boiler was without dome, which made it the strongest possible with the least cost. By using the small ports in cylinders it reduced the friction to a minimum, with least clearance. As long as the openings on cylinders are larger than the "exhaust nozzles," there will be no trouble in getting steam through them.

There is the same time to get steam into cylinder as there is to get it out of the exhaust nozzle, and the pressure is much greater when going in, and there is no use of steam pipes being larger than to allow what steam the boiler can make to pass through readily. There can be no more steam used in the cylinders than can be made in the boiler, and when the time arrives for the use of *facts* in place of *theory*, these engines will be known so well that "Indicator," with his books, will have plenty of time for a vacation—for it takes something besides *theory* to get heavy trains over mountain roads on time. "PRACTICE."

East Albany, N. Y.

A Wrong Idea of the Water-brake.

Editor The Locomotive Engineer:

There is an interesting little engine running here on the Deadwood Central, and she has a little water-brake. She is a 12x18 inch cylinder, three pairs drivers, no engine truck and no tender. She carries her water over the top of the boiler, and her coal under the seat-boxes. She has always burned wood until very recently, because it is only about two months now that she has had any connection with the outside world.

She was hauled here by ox teams, and has been pulling passenger between here and Lead City, 3½ miles, for about two years.

Her water-brake is attached the same as any other. A pipe tapped below water line of boiler leading from the cab is teed and taps the two exhaust cavities from the back side of the saddle. "Betsy" has seven per cent. grades to descend, 360 feet per mile. When she starts down, the engine is reversed, the water turned on, and cylinder cocks left closed; she shoots the water out her nozzle into the front end. They have found it necessary to put a drip pipe on the smoke arch to drain the water away.

The men who run her say she never gets any water into her cylinders on the valves. Her valves and cylinders wear as nice as any engine could. This is something different than is ordinarily claimed for the water-brake. Anything on the water-brake question will be of interest here.

Deadwood, So. Dak. BLACK HILLS

[If the lever is kept in the reverse position from direction the engine is running, she will certainly pump water from the exhaust passages to the steam chests and cylinders, and this is what the water-brake is for, to lubricate and cool the moving parts. The cylinder cocks should be opened, and no more water used than can be comfortably worked through them, the speed being regulated by changing the position of the reverse lever. There is great danger of knocking out cylinder heads by closing the cylinder cocks and handling the lever close to the center.]

Air-pump Lore—Hot Pipes—How to Start a Pump.

Editor The Locomotive Engineer:

That cut of mine last month didn't illustrate very well. I wanted to show that steam had cut out metal around the steam port and down into the space below the bushing, thence to the cylinder. E. C. N., of Mandan, N. D., had it right.

In reply to F. B. A., will say that I have seen pipes cherry red. It is caused by contracted passages, and too rapid pumping of the air. It is the friction of the air in the pipes that produces heat. This is usually the result of poor judgment, as a rule, of man in charge of pump.

An air-pump should be started just as you would your engine when getting her out of the house.

Of course it is sometimes necessary to run pumps fast, to supply leaks, etc., but there is no excuse where leaks could be cured by the simple use of a wrench.

I presume we will soon have plenty of fresh "conundrums" here, as we are to have the "train signaling apparatus" in use on or about June 1, on the N. Y. C. W. F. RELYEA.

Syracuse, N. Y.

Lamps and Whistles—More Experience.

Editor The Locomotive Engineer:

Perhaps if I tell my story about lamps and whistles some professor or scientist may come to a solid conclusion about the cause of that little trouble. My first experience with that was when I was firing a Cooke engine over the Sierra Nevadas some years ago; the whistle was a very bass one—in tone—and the lamp was a common square tin gauge lamp, with glass in front and back. This whistle would put the lamp out every time that a blast of two or three seconds duration was blown in the snow sheds or in a tunnel, but out doors or in the open air it had no effect on the lamp. There was no effect at any time on the water glass lamp, no matter how long the whistle was used. Later on I was running a McQueen engine, the cab of which was not very high above the boiler head, and the whistle of which was quite coarse, or bass, in tone, the lamp was a globe lamp with a brass ventilator top and a brass shade around the globe. I had to put a block in this whistle, for whenever I used the whistle at night for a blast of more than two or three seconds duration the flame in the lamp would flare up till it was more like a torch, and as the sound ceased the flame would then die out almost entirely, until the wick was turned up again. In this case, too, the water glass lamp was unaffected; in fact, I have never seen one of these lamps that was; it has been the gauge lamp located near the top of the cab.

I ran another McQueen engine that had a shrill whistle, with a low cab and a lamp that is in common use on the Central Pacific, the globe of it is about four and one-half inches high, and there is no sort of top or ventilator to cover it, the orifice being about two inches, or a little less. In leaving town with this engine in the night time, the first time I used this whistle for a road crossing I had to be very careful, or out went the lamp, if it went out I could depend on having no more trouble with that lamp after lighting it again, but if the lamp flame recovered itself after the first use of the whistle I had to be careful for the next one or two times—after that no more trouble.

Still another. I took the place of a man on a daylight local run for a while, which, in the winter time, extended just far enough into the evening to need the lamps lit for a little while, the fireman used to watch me, and as he saw me reach for the whistle lever he would place his hand over the open top of the lamp globe, and save the flame that way, otherwise he would have to light the lamp again.

Not long since I got hold of a Baldwin engine that had a bass whistle which would put out the headlight nearly every time it was used.

Now who can explain the causes of these phenomena? PACIFIC.

Sacramento, Cal.

A Bad State of Affairs on Account of the Chain Gang System.

Editor The Locomotive Engineer:

The beauties of the pool chain gang system are being beautifully exemplified on the Georgia Division of the E. T., V. & G. Let some advocate of the system take a trip over the road, and I will venture to say that he will change his mind very quickly. Engines that six months ago could handle thirty loads are being reduced to twenty, and it is a hard matter to "get there" with them. All classes of the men are dissatisfied, consequently there is a monkey and parrot time among the men and officers. Thirty to forty-eight hours is consumed in making the trip of 158 miles. Engineers' overtime amounts to more than their mileage in many cases.

Rome, Ga. O. T.

On Spring Rigging.

Editor The Locomotive Engineer:

I would like to ask our friend, L. C. Hitchcock, to give some details on spring gear, how to arrange for proper lengths of hangers, etc. We have several sets to rearrange in the roundhouse. Would like to know the amount of compression to give (if any) before the weight of engine comes on.

Suppose an engine turned out of shop with center of main driving axle ⅛" out of square with cylinder line. Would it materially affect the setting of the valves? O. K.

Ottawa, Ont.

We referred the above questions to Mr. Hitchcock, and received the following reply:

The question has been asked, What should be the proper length of driving spring hangers to give the springs the proper tension before the weight of the engine comes on them? That depends very much on circumstances. To answer this question one should know the kind of spring to be used, its length, number and size of leaves, temper, set, etc. Then he should know the kind and weight of engine and number of springs to be used.

Most of our engines are the American eight-wheeled type total weight on drivers about 60,500 pounds, in these we use 12 leaves of $\frac{3}{8}$" x34" steel, length from center to center, 36$\frac{1}{4}$"; set, 12". These we give from 1$\frac{1}{2}$" to 2" tension before the weight of engine comes on them, and get very good results. We do not give the forward springs more tension than the back ones.

In regard to the second question, I should say that if all other parts of the engine were properly constructed you could not make each side of the engine work the same under these circumstances, but think that, if the valves were properly set, this defect would not be noticeable in the exhausts of the engine. L. C. HITCHCOCK.

Minneapolis, Minn.

Hood's Breakdown.

Editor The Locomotive Engineer:

There has been quite a discussion here between some of our old engineers, and others of the boys on the D. S. S. & A. Railway about bringing in an engine with a left back-up eccentric broken. Some of them claim that they can bring her in by connecting the blade of the left back-up eccentric that was broken to the go-ahead eccentric, with the same results that L. L. Hood gained by blocking his engine in the extreme forward notch; and some claim that it cannot be done. I do not know for certain, but think it could be done. We would deem it a favor if you would kindly give us your opinion whether it could be done or not, and, if it could be done, would it be practical to do it if you should happen to break down on the road, and not be able to handle your train on one side, that is, providing the master mechanic would allow it?

ONE WHO IS ANXIOUS TO LEARN.

Marquette, Mich.

[It would be possible if the back-up eccentric or strap were so broken, and there was lost motion enough to bolt the back-up eccentric blade to the go-ahead strap, but it would be a slow job, and would require special conditions for success. If the rod was so fastened the engine could be hooked up, but not reversed. Engineer Hood disconnected his engine the quickest and best way under the circumstances.]

Completed History of the Old Locomotive "Brookline."

Editor The Locomotive Engineer:

Just a year ago this month (April) you illustrated the old engine "Brookline," with a history of her service up to the time her name was changed to Farmingdale, and she was sold to some Eastern road.

It may be a little late, but I think perhaps the remainder of her history will be of interest to your readers.

I have run her, and was running her the very last time that steam ever turned her drivers. She was bought by the Portland & Kennebeck road, and run on the accommodation train between Augusta and Gardiner. I ran her some time when she was a drop hook. She was taken into the shop at Augusta by our master mechanic, John Ellis, and he changed her into link motion. I was running her when we had a collision, between Gardiner and Hallowell, on June 27th, 1870.

Engineer D. H. Berry was running the old "Patten" on a mixed train, Charley Merrill, conductor. In this collision Berry was killed and the fireman fatally scalded; no passengers injured.

I helped get the passengers out of the wreck, and did what I could until the arrival of Master Mechanic Ellis with a wrecking crew.

In clearing up the wreck, Mr. Ellis found the name plate "Farmingdale," and gave it to me, saying that her name belonged to me. I have it yet.

My conductor at the time of the wreck of the historic old engine was John Holmes, everybody in this part of the country knew him; he was a stage driver between Augusta and Portland before there were any railroads; he died about two years ago. I am still running a locomotive on the same road, now a part of the Maine Central.

Brunswick, Me. C. M. EVANS.

Marks is Bound to Have a Job when His Locomotive is Out of Date.

Editor The Locomotive Engineer:

Since writin' you about that job when ther locos went ter scrap I've bin lookin' round and rather think I've got hold uv sumpthin' that may pan out, even if ther railroads try ther lightnin' skeem. There is two plans I'm on ter, as ther boys say, and as there is prob'ly sum others that will be wantin' ter know how ter git ther cash fer flap-jax and such eatin', will give them a pointer.

Wun skeem is only good fer a winter job, but it's a howler while it dus last.

We hav' all run when ther tracks looked as if they was all ice, but just think uv runnin' on ice fer a steady job all winter. Wal, this is just what ther plan is, fer I've bin readin' uv a new skeem by a man named Mulrey, uv Jersey City, and shall see if I can't git a job when ther locos begin ter go ter scrap. 'Taint no slow thing nuther, fer he says it will run sixty miles an hour and not mind sech little things as lumps uv ice and when you think uv jumpin' ice chunks on ther run 'taint no slow work, don't have ter dodge 'em either.

Must be sort uv a wunderful sort uv thing, but this is an advancin' age, and such ideas as we get from ther old roads are no good any more, anyhow ther man that made ther engin says, "it's all springs and ball and socket j'ints," with cars ter match.

Jest imagin' me, ther old plug puller that used ter run ther old scrap heap, er steerin' this new kind uv go'r, all ther j'ints er givin' and twistin' and er humpin' herself over the stray cakes uv ice that may be left lyin' round loose by ther careless ice cutters. Guess 'twill seem kinder strange ter me, but I must do sumthin', and if ther j'ints only hold and don't twist too much, I'll run ther thing, if I hav ter be tied down ter ther seat, better'n runnin' wun uv them lightnin' motors anyhow, cause if yer do git "fired" off ther seat yer can find yerself again, and not hav' any uv that lightnin' playin' up and down yer spinal backbone.

I b'lieve ther new locos won't be sold, but that needn't worry any uv us runners, cause we don't often buy ther scraps they give us ter run, but I've sent in my cards after a job, and all ther men that know ther best thing ter do better follow suit if they can't trump; but recollect that I have ther first job on ther new ice line and stand reg'lar number wun.

For a summer job I've bin spottin' ther "numatic" skeem, and think it will do for a change from ther ice line, and think it will be a rest too, as ther won't be no hustlin' over the ice blocks and the like.

This skeem is sumthin' like the cable lines that run in cities, has a grip (a double-ended sort of affair) that just grabs on ter the vacuum when they want ter go, and they just fly too—ther lightnin' skeem can't touch 'em.

They just pump ther air out of the tube that lays 'tween ther rails and fire ther vacuum in, and ther piston grip just catches it, and they scoot, 'bout ther same as scrapin' ther lightnin' off ther wire in ther other skeem.

This skeem only has a few pumps along ther route that haul out ther air, so all we can do on this line is to run ther grip business.

This grip business has to push ther slides out of ther way as it passes, and then ther slides scoot back inter place so as ter keep ther vacuum from gittin' out.

Now all they hav' ter do to get speed on this thing is ter pump in more vacuum and they fly as fast as they want ter, with only a few pounds of air they will run two or three hundred miles an hour and never be behind time either, it's a great skeem.

Now when ther cars are humpin' therselves at ther rate of several hundred knots an hour, that ther slides that are floppin' back and forth must make music for ther engineer; other roads don't think that much of ther men, to give them a concert as they travel along ther road.

These slides must hustle to close in time for ther next train, and when you think that there is over ten thousand ter ther mile, and a mile a minit don't give very much time for ther operation; but that ain't troublin' me, that's their part, and as they are goin' ter give me a chance on their cars if I can sell some stock fer 'em, guess I'll work that skeem in with ther other, so as ter make sure of a job when ther locos are all cut up inter motors and ther like, fer them fellers that ain't skeered ter run ther things four or five thousand miles an hour.

Still, if you hear uv a job that wouldn't shake a feller so much as ther ice route, or be so hard on a feller that wasn't a musician as ther tunes ther slides play as they scoot by, why let er feller know, cause I want ter know ther best job ther is layin' round loose and snatch it, afore any one else gets sight of it. R. E. MARKS.

Camden, N. J.

Some Phenomena of the Road.

Editor The Locomotive Engineer:

Back in the '70s some of the drivers on the G. T. R. of Canada had their whistles blocked so that they could put out almost any lamp. Often when on top, near the engine, I have tried to shield my lamp from the whistle while the driver whistled for the station. One engine driver used to have fun with a cranky agent by making pretense of calling for brakes or off brakes when engine was opposite the lamp on the order board, and extinguishing it. Those whistles would often make the fire fly in sparks out of my red mustache on a dark night in rainy weather.

There were not many injectors then. The pumps had "pet cocks" which the driver opened occasionally to see if she was taking water, and which would throw a stream outside of the right of way when engine was running fast. When the sun or moon was shining, and you were running in the right direction, a "rainbow" would appear on this water from the "pet cock." By moonlight the colors would be very pale. Several phenomena that used to interest us "old-timers" seem not to be observed by the trainmen who came up these later years. CONDUCTOR.

Fargo, N. D.

On the C., B. & Q., instead of the usual signal bell in the cab, or the whistle air signal, they use a small whistle located on top of the cab and blown by steam or air. A heavy coil spring holds the valve closed, the bell cord being attached to the spring. It is just as hard to operate from the rear of a long train as the old bell, and is fully as uncertain—but it's different.

New Form of Flexible Wheel Base Tramway Locomotive.

The peculiar locomotive shown on page 89 was designed for a special purpose, and is, to say the least, a very ingenious piece of work. The inventor and builder, Mr. E. P. Cowles, of New Decatur, Ala., has built several of them, and they are running successfully. He describes them as follows:

This engine is especially designed for use in lumbering, quarrying, etc., where the roads are built temporary by reason of requiring frequent removals, and are as a consequence very rough and uneven, with many heavy grades and sharp curves.

It follows from the nature of this service that the engines are mostly used in sections remote from repair shops. It is therefore desirable that they should be so constructed that they can be kept in order and repaired by such mechanics and with such materials and tools as may be at hand. In this respect should be on the same grade as the ordinary stationary engine.

The object sought and attained in this engine is to produce, at a reasonably low cost, a thoroughly reliable and serviceable locomotive, having the greatest possible tractive power, by utilizing the entire weight, including fuel and water, for this purpose, combined with a degree of flexibility never before attained in a locomotive without the use of gear wheels, slip and toggle joints, so objectionable as a source of breakage, lost motion, noise and unsteady action.

The entire weight of this engine is carried on two independent freely oscillating driving trucks, swiveled to the engine frame like ordinary car trucks. They are perfectly free to turn and follow curves, or twist to conform to an uneven track, without in the least interfering with the transmission of the power from the engines, which are direct-acting, like any locomotive.

One axle *a a* in each truck is tubular, through it passes the engine crank shaft *b b*.

They are coupled together in the center by a universal joint *c c*.

The truck is swiveled to the engine at this point by hangers depending therefrom. The bore of this tubular axle is larger than the shaft.

On each end of the shaft, just outside of the wheels, is a double crank *d d d d*, to which the main rods *e e e e* of the engines are coupled. These cranks have journals outside, with bearings *f f f f*, sliding vertically in hangers depending from the engine frame. The hangers maintain the crank-shaft always at right angles to the longitudinal axis of the engine, while they are maintained parallel to the plane of the frame by rock shafts with arms connected to the bearings *f*.

The wheels of the tubular axle have ring-like crank-pins *g g g g*, coupled to the other wheels of the trucks. The wrists of the double cranks pass through these rings.

They have the same play in them that the shaft has in the tubular axles. It is obvious that while the crank-shaft is maintained in the same position with reference to the engine frame, the trucks are free to oscillate in every direction to the extent of the play of tubular axle on crank-shaft, and at the same time the rotary motion is transmitted to all the wheels as rigidly as if the main rods were coupled directly to them.

The engine frame forms a platform on which the boiler, cab, fuel-box, tank, etc., are placed. It is made with two heavy, strong sills, lying directly over the cylinders, and performs much the same office as the bed-plate of a stationary engine.

Besides maintaining the engines in line, they also take all the working strain, relieving the trucks entirely of the thrust of the engines.

This permits of a perfectly strong, durable truck frame being made of a combination of wood and iron, like those of a passenger coach. As far as possible, iron is bolted to wood, reducing the liability to breakage to a minimum.

The wheels have chilled cast rims that can be removed easily. Two men can remove the worn out tires and put on new ones in six hours, or replace them with those of a shape suitable for wood rails.

Besides the usual truck springs and equalizers there are bearing springs between the trucks and engine frame. On a very rough, uneven track, the engine runs as smoothly as a passenger coach.

The cylinders are placed midway between the trucks, with piston rods extending through each head, one connected to the rear, and one to the front truck. To compensate for the varying length of the main rods, owing to their angularity, as the cranks approach the upper and lower points in this revolution, the piston heads are made double, one *h h* annular connected to one piston rod by a perforated disk, the one connected to the other rod solid *i i* fitting steam tight inside the first, and having a longitudinal play equal to the variation to be provided for. Their areas are equal, and obviously steam acts on each with the same force. At the same time they are free to draw out to accommodate any variation in the length of the connections. They are provided with steam cushions, which prevent concussion in case the wheels of either truck slip.

The engine illustrated weighs eight tons, which is equally distributed on eight driving wheels 28 inches in diameter, width of gauge, 42 inches, length of truck wheel base, 42 inches, total wheel base, 16 feet. It will turn curves of 50 feet radius and twist 10 inches in the length of its wheel base, cylinders are 10 inches diameter by 12 inches stroke. They have balance valves and can be reversed under full pressure of steam, slipping the wheels either way. The trucks are provided with steam brakes, which are also arranged to be worked by hand. Sand-boxes are provided at each end. It will run and haul equally well either way. The boiler is of the upright type. The tank is of strongest and simplest form possible. A plane cylinder placed horizontally in front of the boiler. The cab is roomy and neat, making it easy and agreeable to fire and run.

This engine has hauled four empty cars of 4,000 pounds each up a grade of 600 feet per mile, turning curves of 50 feet radius, having a grade of 450 feet per mile, at the rate of 12 miles per hour. It has run on a reasonably straight track at the rate of 25 miles per hour, and this on 16-pound rail.

The engine is covered by three patents, with others pending.

A New Ten-wheeler for the B. & O.

The B. & O. shops at Mt. Clare, Md., have recently turned out a new pattern of heavy ten wheeler that is destined to become their standard freight engine.

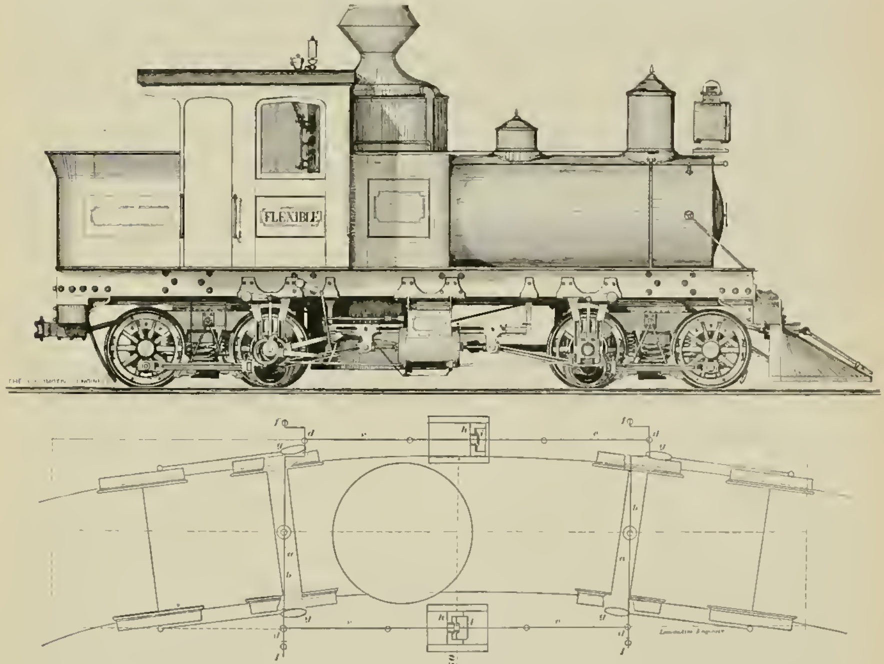
These engines have cylinders 21x26, straight radial stay boilers 64 diameter, and a 60 wheel. The two forward driving tires are bald.

A very neat steel cab is used, and wrought-iron doors of a very heavy pattern are swung from each side of the tank, and take the place of coal boards. The main rod is fluted or is of I section. The fire-door is the double sliding door of English pattern. The Pennsylvania style of double bar guide is used. Cast-iron rockers of heavy pattern are employed.

In the cab they have devised a rather clumsy steam box, from which most of the valves radiate like quills upon the fretful porcupine.

This engine is fitted with Sellers re-starting injectors, air brakes and steam heat. The use of the latter is not stated for a freight engine, but this first one, it is said, will pull heavy excursions during the season, and so has passenger equipment. Just what use steam heat will be in July and August is not stated.

The engine, on the whole, is a very good and handy one, and is a big improvement over the present freight engines of the road.



NEW FORM OF FLEXIBLE WHEEL BASE TRAMWAY LOCOMOTIVE

LOCOMOTIVE ENGINEER.
DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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CONTENTS

Examinations of Enginemen.

For years there was little or no examination of enginemen, especially of firemen about to be promoted, but within the last few years there has been considerable agitation on the subject, and now there is liable to be a lot of examinations formulated that are as absurdly too great as the old method was too small.

It is of great importance that the engineers of this country be well selected, well posted and able men; it is of just as much importance to the engineers as to anybody else, but it is also of great importance that the examination be of such a nature as to prove the engineman's knowledge of *operating* locomotives, not of *building* them or designing them.

The future engineer should be molded, acquiring certain knowledge at a certain time, and gradually rounding out his education and experience until he becomes a master of his business. Incompetents and drones should be kept out of the way of earnest workers, and the latter given all the chance in the world.

The present method of making engineers is as crude and as illogical as it would be to send a child, entirely uneducated, into a high schoolroom; pay no attention to it, never give it a lesson to learn, never call it to a class or hear it recite, and at the end of four years call the child up, critically examine it in the higher branches, and make it principal of the school, at the same time telling it that it was not well posted, and you would not be surprised to hear of its failure.

To the end that future examinations may be fair to both sides, logical, require knowledge that is necessary, and not require knowledge that is not necessary, and to insure a well-selected and well-posted class of locomotive engineers, the editor of this paper offers a plan for progressive examinations of locomotive enginemen in another column, only hoping that in some measure it may be a means to the desired end.

The writer is thoroughly convinced that it does very little good to put green firemen on switch engines in order to fit them for road service. The work is so entirely different that it does little real good. The only advantage is that it employs some of them near by where they are available when wanted. Two trips on a road engine at the start, when applicant is anxious to learn, is worth six months' yard work.

We believe that any master mechanic who will try the following plan will appreciate its advantages.

Keep applicants on extra laborer's or wiper's list, and keep in the shop or roundhouse, on running repairs, one or two old firemen who have passed their final examination; they are where you can reach them on short notice, and can be used either as extra firemen or engineers; they are experienced, and can be had as firemen on the most important trains in an emergency—you feel safer knowing that a capable fireman is out on the fast run. If a freight engineer don't show up, you have a man within call that you can use.

Cost of Being "Odd."

A look through any locomotive shop will at once convince an observant mechanic that there is no more attempt at uniformity or standard patterns now than there ever was, probably there is less.

If everybody tried to build alike, probably little progress or improvement would be made, yet many of the so called road standards are peculiar, to say the least.

Several large orders for equipment have lately been given, that will involve a large expense for special patterns and special tools to do the work, that will in no way add to the earning capacity or facilities for repairs. Does it pay?

The president of one of the largest roads in this country recently visited a locomotive works to protest against the delay in delivery of an order of upward of fifty locomotives of two or three classes. When told that the delay was caused by the necessity of making new, or altering old patterns, in constructing special hammer dies, odd thread taps and double-barreled reamers before work could be commenced at all, he became interested.

When shown that the stock patterns of the works, the standard screw threads of the country, and reamers of established taper that could be purchased in the market, would have been just as good, if not better, he said he thought it too bad to go to so much trouble.

When told that the following of the specifications to the letter would delay delivery about four months, he was out of patience, but when told that the same number of locomotives of the same size, capacity and efficiency of the standard pattern of the works could have been furnished for nearly two thousand dollars less for each one, he was downright mad.

To be sure, many of our master mechanics are not responsible for the mechanical devices they are in charge of, they are a legacy from some predecessor; but it is a question whether or not the head of a mechanical department is justified in virtually bringing into the world a large family of feeble-minded children, just to match those of his wife's by her first husband.

Wouldn't it be better to start new and let the old die off?

This, of course, is a matter that each must decide for himself, according to the particular circumstances in which he finds he is placed.

Certain it is that motive power on many of our roads is costing from five to twenty per cent. extra on account of little eccentricities of design.

Dampers—Need of a More Perfect and Simpler One.

In the days of wood burners it was not so difficult to keep ash-pan dampers tight as it is now with coal, and all know that, with comparatively air-tight dampers, properly manipulated, a great deal of blowing off of steam was avoided.

In Scotland and several other European countries it is not uncommon practice to make ash-pans of cast-iron with the damper joints milled, so that the pans are water-tight; when these dampers are closed, after steam is shut off combustion is checked, and little or no waste occurs.

In America the damper has fallen sadly into disuse; this has been caused by the great difficulty in making or keeping pans tight in the very large class of American locomotives whose fire-boxes are located above the frames, and especially so where there are one or more pair of wheels under the fire-box.

Hard coal engines are, as a rule, of this class, and it is a treat to see a hard coal ash pan not warped out of shape by heat.

On the continent of Europe it is not uncommon to see locomotives with netting air spaces in the ash-pans, like many American engines, and no ash-pan dampers, but a damper on or in the smoke-stack.

This damper answers every purpose of ash-pan dampers, as far as checking the draught is concerned is but a fraction of the weight of the old dampers, is not distorted by heat, is away from the track, costs far less than any ash-pan form of damper, and is always easily operated.

The general form is in the shape of a disk of iron that is so arranged as to be easily turned to cover or uncover the top of the stack; this disk usually has a small hole through it, just enough to let the gas escape.

It is the plan on the Lehigh Valley and other hard coal roads to lay a piece of tank iron on top of the stacks of engines standing in the roundhouse with fires banked. This is the stack damper, to all intents and purposes. It seems as though, with one of these dampers on our straight stacks, with a handy lever in the cab within the reach of engineer or fireman, that this howling of the pops on long down grades, around yards and stations, and in roundhouses, could be considerably checked, and a lot of alleged dampers, that look more like propeller blades, together with their deck handles, rods and bell cranks, could be dispensed with.

Our cousins across the big salt lick beat us a little on fuel consumption, and we credit their firemen with knowing more about their business than ours do; but suppose you educate a fireman up to understand that steam wasted at the pop is wasting fuel, and that he could save it if he checked the draught, and then provide no means of checking it, what good does his education do? If these stack dampers answered no useful purpose, those Germans and Italians and Frenchmen would not go on building them year after year.

Isn't there a field for this simple device here?

A Move in the Right Direction.

The adoption of a six foot and a half wheel by the B. & O. for their new fast express engines was a step in the right direction toward higher speed for light trains, the next will be the introduction of a similar engine with a single pair of drivers, no side rods, a four-foot trailing wheel under the fire-box, and a fire-box fifteen inches deeper and eight inches wider, made possible by this construction

As this paper goes to press, the editor turns toward the golden West to see if there is not something of interest to write about on the Pacific slope. The next issue of the paper may be better or worse for our absence, and we hope our readers will excuse us in the one case, and the paper in the other. There are no subscriptions owing, but we may as well remind those who think they owe the editor anything in the shape of chastisement, that May is the month in which to call and settle.

Don't worry because you are not a brilliant man. Brilliant men don't accomplish as much in the long run as the one who does a little every day. Keeping everlastingly at it is what accomplishes results. You are all right so long as you accomplish an object, make a point, or advance a step each day. You will move slower per hour, but faster per year. Your brilliant men make magnificent jumps, and look pretty while in the air—but they often light on their stomachs.

Correspondents who have a personal grievance against some road should air their grievances to their committees or organs of labor orders. This paper must stick pretty closely to mechanics, and not go far out of its way to discuss abuses of operating officers on the Reading—or any other road.

The best smoke preventer is an intelligent fireman who has been carefully trained in his business—it also helps matters to have the engineer know a thing or two.

Communications written on both sides of the paper go to the scrap heap without reading—life is too short.

Book Review.

BOILER MAKING FOR BOILER MAKERS. By W. H. Ford, M. E. John Wiley & Sons, New York. Price, $2.

This little book of 225 pages is a practical treatise on work in the boiler shop, and is written in such language as boiler makers understand. It shows the approved methods of riveting, staying, bracing, punching, drilling, smithing, and shows the economical points of boiler shop management. The author of this work was a mechanical draftsman, whose work drifted into designing and laying out material for boilers. He saw the need of a practical work on boilers, and tried to buy one, but did not run across the ideal one in mind; he commenced keeping a note-book and to gather data, and this work is the result. The work is not a brand new thing, but has reached its second edition.

A great many engravings are employed, and the work abounds in kinks, tools and appliance ideas, any one of which is worth $2 to a boiler maker.

ASKED & ANSWERED.

(37) G. H. M., Eagle Grove, Ia., asks:

What would be the cause of an engine not cutting off the same at both ends of the cylinder, after having been squared up in the corner, and found to be all right? A.—If the valves are square in the corner for both forward and backward stroke, the probable cause of their being out when hooked up is that the point of suspension or the tumbling shaft are not correctly placed.

Progressive Examination of Locomotive Engineers and Firemen.

QUESTIONS AND ANSWERS.

By JOHN A. HILL

EXPLANATORY.

So much of the examination of firemen for promotion to the responsible position of locomotive engineer is unsatisfactory on account of there being no proper system of training, and there is withal so much uncertainty as to what a man really knows, even after he has passed an examination, that the author of this plan has been encouraged to propose it. He claims no originality in the questions or answers, but has selected the simplest and best from every available source. The only original proposition is in using a series of progressive examinations to insure good material to start with, and aid and assist the fireman to learn the proper things first and provide a screen to prevent the advancement of incompetents.

Every child is taught to creep before it walks; the primer comes before the fifth reader; kilts before pantaloons, and youth before manhood. The boy in the shop is put at some laboring or helping job, where he has an opportunity to observe, see others work, learn how, and why, and what; he becomes a mechanic step by step—not at one stride—he is not put on a drill press for three years and expected to become a mechanic.

Mankind, profiting by the experience of past and passing generations, and learning first the rudiments, then the elements, finally reaches proficiency in such calling as each individual elects to follow

A young man who has attended a soda water apparatus, sold pain killer and swept out a drug store for four years, is not made prescription clerk ahead of the youth who has studied chemistry and has been employed three years as assistant to the prescription clerk—knowledge is necessary before assuming responsibility.

Locomotive engine running is a responsibility, than which there is no greater, and the most painstaking care is none too efficient in selecting and training men for this more than responsible position.

The way to secure a good class of engineers is,

First. Select good, clean material, inspect for culls, and have some quick and fairly accurate method of testing for such defects as would prevent the candidate from ultimately becoming a first-class passenger engineer

Second: Provide the opportunity and means, or point out the way, to the student to learn the rudiments of his business first—teach him how to fire, before he goes head-over-heels into valve motion.

Third: Provide an incentive to the learning of the right part first, and establish a point at which no progress or any other defect in the candidate for advancement will call for a termination of the apprenticeship.

By the method here proposed, responsible officers can provide a system of *periodical* examination of firemen, advance them step by step until they become thoroughly proficient enginemen, and abandon the usual rule, of putting a conglomerate gang of men upon locomotives, letting them fire a term of years, and select the oldest for examination, only to find that he knows little about his business, that he is color blind, illiterate, or intemperate—all of which should have been discovered before he was given a job at all.

The Progressive Plan provides in the preliminary examination for the establishment of a gauge for candidates, one that proves that he is possessed of a common school education, is not afflicted with defective vision, personally desires employment in this line of work, and is prepared to stand its hardships, with the hope of promotion; is of proper age, and points out to the candidate what he is expected to learn and how best to learn it.

The first examination occurs after one year's actual service. The record of the candidate for advancement is looked up, and he is examined in the rudiments of his business, the questions being of an elementary order, to see that the subject is getting the proper groundwork of his trade. Especial attention is paid to his understanding of all signals in use by the road, as even the youngest fireman is responsible for the proper transmission of signals to his engineer, this point is especially important on single track roads.

The second examination takes up the subject of fuel, combustion, boilers, and the duties of firemen. It insures his understanding something about the care of fires, draught appliances and economy of fuel, while he can still put in practice some of the lessons learned.

The third examination occurs after the third year of service, and is a thorough one on the mechanism of the engine, brakes, etc. The examiner requires a remedy or a cure for every conceivable break-down liable to occur on the road; and this examination should be complete enough to warrant the superintendent of machinery in promoting the successful firemen as needed, upon their presenting him with a certificate of examination on train rules and time card from the proper officers of the transportation department.

If the candidate fails to pass satisfactorily at this examination, he is to be apprised in detail where he is weak, and given a chance to post himself and try again when his term for promotion comes—for with progressive examinations there can be no objection to "the oldest man" coming first.

The early examinations are mainly to secure the proper material and then put the young fireman in the way of himself getting hold of the right kind of information, advise him, guide him, and get him in the way of *thinking* and reasoning out things for himself

He is led to study certain important phases of railroading at a time when he needs information on these subjects most, and those who are inclined to put off and lag in interest are kept moving by the thought of the next examination

Some objectors will say at once, "Oh, they will learn those rules by heart and repeat them off like clock-work." Even so, this will do good rather than harm—and is far more than the majority of men learn before promotion now.

These questions and answers are intended principally as a guide to the kind of questions that will be asked, in actual examinations—fewer questions will be used, but on these subjects.

It treats only of such parts of mechanism and such conditions as are common to all locomotives and to all railroads, and it is expected that the officers of each road will add to it important subjects of a local nature—such as the water scoop on the Pennsylvania, the smoke-jet on the New York Central, and the water-brake on the Rocky Mountain roads

PENALTIES

First Examination. Discharge for proven charges of drunkenness, insubordination, or chronic quarrelsomeness. If more than half the questions asked are missed, applicant to go back on the list six months and again come up in his new turn. Demand perfection in examination on signals. On second trial, if applicant shows no capacity to grasp the subjects, and a disposition to be lazy or indifferent, dismiss him. He will make the same kind of an engineer that he does a fireman, and—you don't want that kind.

Second Examination: Same as the first.

Third Examination. If applicant for advancement has passed former examinations all right, and seems from his answers to understand the subject generally, but is unable to give the correct answers to specific questions, it would be well to correct him or give him a few days to get the matter straight. If, on the other hand, he gives evidence of not understanding the subjects treated, and would not, in your estimation, be a safe man to trust with a locomotive, he should be sent back to firing for six months, taking his turn behind the men hired the six months after he was. Failure on the second trial should at least call for taking candidate out of road service.

TO THE EXAMINER

Bear in mind the experience of the man being examined. Do not think for a moment that your mission is to humble him, to "catch" him, to impress upon his mind how densely ignorant he is and what a store of railroad knowledge you possess. Your real mission, especially in the examination after the first and second years of service, is to find out the progress made in certain lines and guide the appren tice in the right direction, showing him what it is especially necessary for him to know, and giving him advice how to gain the desired information. Be impartial, patient and just, and, above all, avoid making yourself a bugbear to those to whom you are supposed to be a leader and guide.

In final examination, if possible, go with applicant to a locomotive under steam and propose your breakdown problems rather than have him come to your office—the man will feel more at home and give more intelligent answers.

If an answer is given that is manifestly the result of inquiry, but is wrong, ask the man's engineer the question; if he answers it the same, do not blame the applicant.

TO APPLICANT FOR EXAMINATION.

Suppose you have passed your preliminary examination, been given a book of rules and examination book, and have fired a year. Be sure before you go to examining officer that you know what you are going for, and are at least thoroughly conversant with all signals in use on the road, and know something about combustion. Be orderly and cleanly, and go to examination fearlessly—the examiner can't hang you. If there is any subject that you cannot settle on the true solution of, ask those above you, even to the examiner. Remember that the exact questions here shown will not be asked, so that it will do no particular good to commit answers. What you want is a fair, practical knowledge of the subject, then you can answer any reasonable question upon it. Don't try to "post up" for examination day—get posted and keep so. Remember not only your life, but the lives of others depend upon your knowledge of your business, especially about signals and train rights. Work on a locomotive in either place is a serious business and worthy of your earnest thought and attention.

PRELIMINARY EXAMINATION.

NECESSARY QUALIFICATIONS OF APPLICANT.

Applicants for the position of Locomotive Firemen on the . . . . Railway.

Must be more than 18 and less than 30 years of age, unless applicant has had previous experience on a locomotive; if under the age of 21, consent in writing from parents or guardian must be submitted; those between the ages of 21 and 25 preferred.

Applicant must have a common school education, at least equal to the grammar grades of the public schools of the State—graduates of regular high schools given preference.

Must be strictly temperate, of good moral habits, and physically strong enough for the arduous work of firing.

Applicant must be able to distinguish the color of flags or lamp signals—such as actually used on the road—across a space provided, not more than one-fourth of a mile, through the open air; must prove to the satisfaction of the examining officer that he is not defective in vision or hearing.

Possessing these qualifications, and the road being desirous of employing men, he is permitted to make out an application in writing, in presence of the examiner.

FORM OF APPLICATION.

. 189

To the chief officer of the Motive Power department of the . R. R.

Being extremely desirous of securing service on this line in the capacity of locomotive fireman, with a view to future promotion, if found proficient, I make the following statement:

My full name is . . . . . . I was born at . . . . . on the . day of 18. . and am . . . . years . . . months and days of age. I desire permission to ride for a few round trips over one division on regular freight to learn my duties, the location of tanks, signals, etc., and will assist the regular fireman all I can in order to the better understand the work (can be omitted where fireman has had other road experience, but is desirable). Should I still desire to secure a position as fireman, after seeing the actual service, I will come and so report to you.

I am (single or married) . I have been employed by this company before as . . . Former occupation . . . . Experience on other railroads . . . . I can be found at . . . . but sincerely hope you can find a place for me in the wiping force or at some other work where I can be instantly available as an extra man in any emergency that may occur.

. . . .

[Record of former experience will be investigated.]

It is important that the applicant be given permission to ride for a round trip or two on the class of engines he will have to fire, be obliged to remain on the engines as long as the crew does, and perform as much of the fireman's work as he can; if he persists in being an engineer after this he is in earnest, and his time so put in should be paid for at regular fireman's wages—it is a good investment.

QUESTIONS AND ANSWERS.

Examiner. If freight train No. 10 ran from A to B, six miles and a half, at the rate of 15 miles per hour, how long would it take?

A. Twenty-six minutes.

Q. How long does it take a passenger train traveling 30 miles per hour to make a mile?

A. Two minutes.

Q. If this road has 350 engines, each making 100 miles per day, how many miles do they all make per day?

A. Thirty-five thousand miles.

Q. Suppose each fireman wasted half a cent's worth of coal a mile by letting steam blow off at the pops too much, or by throwing away coal, how much would that amount to a day to the road?

A. One hundred and seventy-five dollars.

Q. What do you read?

A. . . . . .

Give the applicant time, and do not try to hurry or "rattle" him, but upon his correct and more or less prompt answers to questions in simple arithmetic like these, you get at his understanding of figures and give him something to think about.

Advice something on the following line would be timely:

You have, no doubt, thought over the matter seriously, and understand something of the duties of the road and its dangers. It is doubly dangerous where any faculty is dormant while on duty; train yourself to avoid sleep or drowsiness on a locomotive; it is a habit that grows, and ofttimes kills. You will have many duties to perform, and it is desirable, and necessary, that you learn to do them not only well, but cheerfully. Cultivate the faculty of getting along well with the men with whom you are at work, and avoid dissensions. Try and please your engineer; remember he has years of experience, you have none. He can teach you much that you need to know; he may appear taciturn, cranky, or close-mouthed, but the meanest engineer on earth will learn to like and help a loyal fireman, who has nothing to say against him or the engine, who tries hard to keep steam and keep the engine reasonably clean, and who is always willing to help him with his work—especially in case of an accident.

Establish now, while you are young, the habit of taking rest as soon as you are in; do extra work, loafing or visiting afterward—you may have to go out before you expect.

Don't forget that it is not the *last* drink that hurts a good man's reputation—it is the *first*. Be temperate. The officers of this road have no right to say to you, "You shall not drink intoxicating liquors," but they have the right to say "We will not employ a man in any capacity that drinks"—and that is what they do say.

Beside keeping the engine "hot" for the engineer, you owe the company a duty in trying to be economical in the use of all supplies, and especially of fuel; remember that when the pops are blowing, they are blowing away *coal*.

On the road, get into the habit of looking at the orders and keeping track of trains running against you; if you are in doubt, ask the engineer; if he refuses to show you the orders, come to me and so report.

Every fireman can afford a little money each year for reading matter, and you should make a study of your business. Take at least one railroad paper, one treating of locomotives and rolling stock preferred, say the . . . . or the . . . . You need Forney's Catechism of the Locomotive at once; you will find it most useful to you now and as long as you remain on a locomotive; Sinclair's Locomotive Running and Management should come next, it is especially valuable because it treats more of firing and running; Alexander's Ready Reference is also a good book, and cheaper than either. Use your books to verify, prove and make clear the problems you encounter in practice.

Your work and habits in the future will be carefully noted, and no habit or fault will be tolerated in you that could not be overlooked in the engineer of the most important train on the road; you must not consider yourself a mere coal shoveler, but as a student earning his way and in training for a most responsible position—we can hire mere coal passers for smaller wages.

Remember that in a year from now you will be required to pass an examination on your business, to ascertain how you are profiting by experience and study. While I shall not confine myself to the exact questions here printed, I give you the questions so that you will the better understand what line of study is best for you. Hunt your Catechism over industriously and you will find pretty nearly everything you want to know in it. Form a habit of thinking of the *why*, and ask questions, of your engineer, the roundhouse foreman, the traveling engineer, or of the Superintendent of M. P.—find out what you want to know.

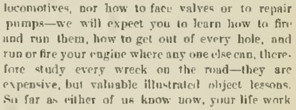
We will not expect you to know how to build locomotives, nor how to face valves or to repair pumps—we will expect you to learn how to fire and run them, how to get out of every hole, and run or fire your engine where any one else can, therefore study every wreck on the road—they are expensive, but valuable illustrated object lessons. So far as either of us know now, your life work will be *operating* locomotives, and your success depends on how thoroughly you learn the business. Be particular to learn all you can about the rules of the road, orders, local conditions, etc. Bear in mind that you may be set back or dismissed the service if you do not keep up with the majority, give evidence year by year that you are going to make a first-class locomotive engineer. I hope to hear good reports of your service.

(First Examination Questions next month.)

An Ingenious Track Gauge and Curve Elevation Level.

Iron track gauges, with three gauging points, are now in common use. They insure the gauge being radial to curves of any degree, and are lighter and stronger than the older forms.

To get the elevation of curves, a notched level is used. The gauge of tracks at curves should be widened an eighth of an inch for each degree of curvature.



A very simple and efficient device to measure all of these requirements has been devised by Mr. William M. Chalk, of Spivey, Kan., an employe of the Santa Fe road.

To the usual iron gauge he adds a spirit level and his invention, which makes the device do the work of three tools. The engraving shows his device. The sliding gauge notch on the end, when at its highest point, leaves the tool simply a track gauge, for use on tangent track. By lowering the slide so that the mark on the scale is the same as the curve of the track in degrees, the device answers the purposes of the old level, and at the same time widens the gauge the proper amount. This is accomplished by inclining the sliding scale, as shown.

The device can be made in sections for easy packing in a case, for convenience in carrying, where used by roadmaster as a test gauge. The inventor wishes to have it put on the market by some firm of makers.

The Engine that was Lost in the Quicksand—The Truth About a Lie.

For the past three months the following item has been going the rounds of the press, sometimes getting itself into a railroad paper as gospel truth. Not one of the editors seems to have thought it worth while to even wonder how they sounded through sand for 100 feet, much less to have gotten hoisting tackle down to take hold of the lost sheep through 100 feet of quicksand. Then the idea of wet quicksand preventing rust by keeping out the air is novel, to say the least, but for the lie:

"Says a locomotive engineer: 'I once had an interesting experience with a quicksand. My engine ran off a low bridge near River Bend, about 100 miles east of Denver, and fell into a small creek filled with quicksands. A wrecking train came up in a few hours, but the engine had entirely disappeared. The railroad officials ordered it to be raised, but it could not be found. We sounded with rods to a depth of over 60 feet, but not a trace did we discover of the engine, which had vanished as completely as if it had never existed. Four years afterward it was found at a depth of over 100 feet and was raised. We then ascertained that there was scarcely a bit of rust on it, the breaks were few, and after a little tinkering it was put upon the road again. The sand had kept out the air and prevented the iron from oxidizing.'"

In a private letter to the editor, Joseph T. Markham, of Denver, Col., now an engineer on the Denver & Rio Grande road, says of this accident:

* * * "The engine referred to here was the '51,' on the Kansas Pacific, now known as the Kansas division of the U. P. She ran into the bed of Kiowa Creek, about one-fourth of a mile east of Bennett station, then known as Kiowa station, which is 31 miles east of Denver, and in Colorado. The accident happened at 12.15 A. M., May 22, 1877. Engineer Johnny Bacon, and Fireman Frank Seldon, and a cook going out to the Hugo section house, were all killed.

"The engine disappeared in the sand by morning, and two other men and myself were sent to search for her. We were furnished with round rods of half-inch iron, from fifteen to twenty-five feet long, and spent four or five days in the search. I am just as sure as a man can be that we found the engine, for we found a solid body about the size of a boiler. It lay about fifteen feet below the center of the track, and twenty feet deep in the sand. Twenty feet further down stream we found the tank, and near it were other pieces. We also found several pairs of car wheels.

"The fireman's body was found the day after the accident, half a mile below the wreck, the cook's body was found the second or third day, one and a half miles below, and the body of the engineer not till the fourth or fifth day, and about four miles away. All of them were on top of the sand.

"The engine was a Baldwin, eight-wheeler, 16x24, numbered 51. I had been firing her just before, but had quit and gone into the bridge and building department.

"It is only about thirty feet to bed rock at this point, so the engine could scarcely go the hundred claimed.

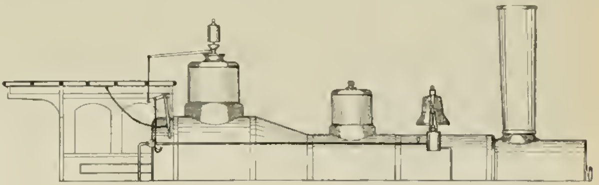
"When we told the man in charge of our department that we had found the engine, and where, he said he didn't want the bother of getting her out, and I do not think anything looking to that end has been tried since. She was certainly still in the sand when I left in '82, and the old timers tell me she is there yet."

In this case the truth is far more interesting than the lie.

What promises to become a very valuable publication has just issued its Vol. 1, No. 1, at Detroit, Mich. It will appear under the name of *The Quarterly Register of Current History*. It is the intention of the publishers to make this quarterly a concise and intelligent review of all current events for the time it is published, as selected from the newspapers of the country. All newspapers are too bulky to preserve, and if they were, a few years of files would furnish the proverbial hay-stack for the preserver to hunt in for the needle of information he remembers he dropped there some time since. The new review aims to present an interesting narrative account of current events that shall be thoroughly indexed and become a useful reference for the library. The subscription is $1 per year.

A New Bell Ringer.

The illustrations herewith show the details of construction of a new bell ringer of very simple design. In Fig. 1 there will be seen two openings for pipes, the one to the left being the steam or air pipe, the one to the right being the exhaust, steam is admitted through upper opening opposite an annular groove in valve 18, through



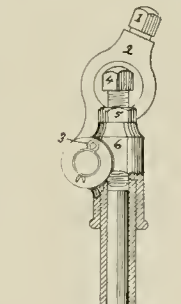


Fig. 1.

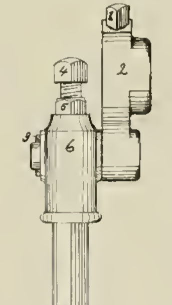


Fig. 2.

which four holes are drilled, admitting the pressure under the single action piston 10, this causes piston 10 to rise forcing the bell to swing. Piston 10 has a stroke of $1\frac{1}{4}$" when at its extreme travel, crank 2 has a stroke of 4. The connecting rod is in two sections, 6 and 7, which allows the crank 2 to make a complete revolution without causing piston 10 to move. When the ringer is started to work, the piston 10 will be driven upward, causing the bell to swing, and valve stem 17 will raise the valve 18, closing steam port, and use pressure expansively by traveling the length of the lap before it will open the exhaust port. The bell having received an impulse, will continue its motion after the piston 10 has reached the upper end of its stroke, the crank box 8 sliding on rod 7.

The impetus which the bell receives being expended, it will fall, the set-bolt 4 will strike the end of rod 7, the piston 10 will be forced downward, coming in direct contact with valve 18, closing exhaust port and opening steam port, after cushioning on the pressure, remaining under piston 10 after exhaust is closed. It will be seen that the valve 18 is only operated at the terminations of the piston, 10 stroke.

Packing rings 15 on piston and main valve are packing rings D 6, No. 8, Westinghouse Air-brake Co.'s Catalogue, 1890. This is the only bell ringer that can be adjusted to use pressure in proportion to the power required. This is accomplished by means of valve stem 17, which is secured in its adjusted position by jam nut 16. No change in length of connecting rod is required in making this adjustment. These bell ringers are in use that cut off pressure after piston has moved ½ on its stroke. This arrangement makes it so economical in use of pressure that air is always used in preference to steam, and it has never caused any trouble with train brakes.

With the use of the automatic starter shown in upper cut, the bell is always ringing when it ought to, and is not forgotten or neglected by the engineer or fireman after sounding the whistle for station or highway. This bell ringer has been adopted by the Chicago & Northwestern Railway and is in use on many other western railways. They are sold at a uniform price of $12 each.

Both the ringer proper and the automatic starting feature are patented, the device is manufactured by the Gollmar Bell Ringer Co., of Baraboo, Wis.

Wound Up.

When the Webb compound locomotive came to this country she excited a great deal of interest. The fact that one pair of drivers could slip with the other pair standing still was a great mystery to those who did not know that the high-pressure engines ran one pair and the low-pressure engine the other, no side rods being used. A few days after her arrival a crowd of shop hands were watching her start a train. The back drivers spun around for a minute or two, but the big piston was on the center and nothing "went away." One shop hand says to another: "Why don't she start?" The other was posted and replied: "He ain't ready yet, he's just winding her up, he'll start her in a minute."

We have a note from a Western engineer, who says that, "Chain-ganging a hog over two divisions is nothing more nor less than a complicated, heterogeneous conglomeration of confused ideas." If it's as bad as all that the practice should be abandoned.

A Peculiar Brake.

Thomas Inglis and William Schiermann, of Tyler, Texas, have recently brought out a peculiar form of chain brake, cuts of which are shown herewith, and the inventors, one of whom is foreman of the Cotton Belt Shops, describe their device as follows:

"This invention was intended to secure an apparatus for cars, to diminish their velocity when running, if desired, or act automatically in case of accident, and not to subject the action of the so-called brake to the accidents of leaking joints, playing out of fine mechanical devices and bad management of brake operators, but to furnish a power brake, and an automatic one, that was simple in construction and did not require skilled mechanical labor to maintain and operate, and in consequence, diminishing the danger of derailment and decreasing the wear of the wheels; through the peculiar construction of our machine, doing away altogether with the brake beams, which cause two-thirds of all the derailments.

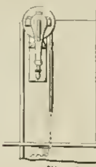


Fig. 3.

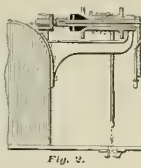
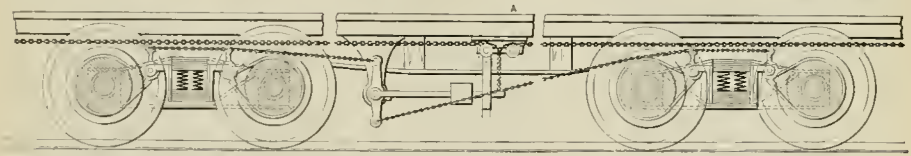


Fig. 2.



"As seen in drawing, we put a brake disk, formed in the shape of a pulley, on the axle of the truck wheels. Around this brake disk is a brake band made out of band steel, that fits close to the brake disk about two-thirds around, and may be lined with vulcanized paper to prevent too fast wearing. Each end of this brake band is fastened to corresponding arms of a three-armed lever, which is fastened and turns on a bolt in an iron bracket which is fastened to the truck bolsters. The third arm of this lever mentioned stands straight up, and through its moving around its fulcrum, the brake band is operated.

"As brake power we employ a weight on a long lever; same weight can be moved back and forwards on this lever, and adjusted to any place to increase or decrease the power with which the brakes are applied. This long lever works around the same pin as the equalizing lever, both levers working side by side, one acting on the other by means of a lug, cast on the side of the equalizing lever. This is an important feature of our construction of this machine, because it makes the brake independent of the movement of the long power lever, on which the weight is fastened, when this lever moves upward. The only effect on the brake is when it is lowered below the horizontal position. By this we overcome the slack between the cars, the lever can travel upwards under the car and down to horizontal position, setting the brake only when brake chain is loose; the brake can be operated by a common brake staff, now in use, by connecting with the main chain; only the work will be reverse from what it is now. You have got to wind the chain around the brake staff to release the brake, and let the chain off to set the brake.

"On a standard car the main chain has a travel of twelve inches to set the brake full.

"One engraving shows the apparatus on the locomotive; a windlass winding a wire rope on a drum takes up the slack in the brake chain. There is a friction clutch behind the drum that can be released to any amount necessary for service stop, by use of a trigger lever shown in the handle."

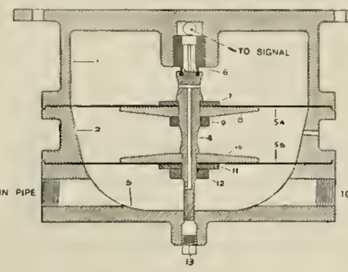
The enthusiastic inventors write us that they are about to try this device on a train, but we fear they will find that the slack of their long chain will be a serious trouble, and that with, say, fifty cars, the well windlass on the engine will have some strain to bear, and the operator some work to do.

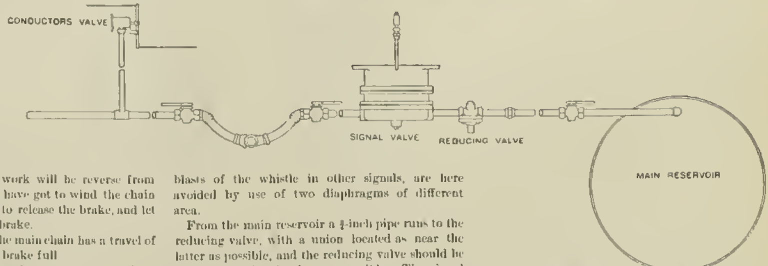
The Boyden Train Signal.

The Boyden Air-brake Co., of Baltimore, have recently put out a new train signal operated by compressed air, like the Westinghouse signal, and interchangeable with it.

The upper engraving shows a section of the engine apparatus, and the lower cut the complete device.

The advantages of this device are: No auxiliary reservoir is required, hence economy of space and construction. A self-adjustability is provided the various moving parts, by which a certainty of action is assured. Simplicity of construction and easy accessibility to all parts. It gives a short, quick blast. No greater discharge of air is necessary to operate the whistle from the rear cars of a long train than from the forward cars. The diaphragms are not subject to deterioration, as they are made of brass; and the vibrations, which cause double blasts of the whistle in other signals, are here avoided by use of two diaphragms of different area.





From the main reservoir a ⅜-inch pipe runs to the reducing valve, with a union located as near the latter as possible, and the reducing valve should be as near the signal valve as possible. The signal valve should be secured to the running board just under the cab. The ⅜ inch pipe from the reducing valve to the signal valve can enter either of the ⅜-inch pipe connections therein, and the whistle pipe should extend into the cab, with the whistle located conveniently to the usual position of the engineer. From the signal valve a ¾-inch pipe extends back to the tender and train in the usual manner.

The operation is as follows: The reducing valve is set to allow about 35 pounds of air pressure to pass from the main reservoir to the signal valve, and from thence to the train pipe; at the same time, this air presses the small diaphragm 5 B, and thereby seats the whistle valve 6, and prevents the whistle from blowing while the train pipe is being charged with air; the air passes through the passage in the stem 4, and charges the upper chamber above the large diaphragm 5 A, and thereby equalizes the pressure on opposite sides of the two diaphragms. The chamber between the two diaphragms is open or exposed to the atmosphere.

When it is desired to give a signal, the conductor's valve on any car is opened and closed as many times as desired; for instance, three times in quick succession, which will produce three discharges and cause three reductions of pressure in the train pipe, and in the signal valve under the smaller diaphragm 5 B, as in the action of the device; the pressure in the valve chamber above the larger diaphragm 5 A will not be reduced by these discharges; the greater pressure there, caused by the first discharge, will move both diaphragms and unseat the valve 6, and air will pass from the upper chamber to the whistle and produce a blast, this will instantly reduce the pressure in the upper chamber below that in the lower chamber, and thereupon the valve 6 will be closed; by this time, the effect of the second discharge of air from the conductor's valve will cause the valve 6 to again open, and the whistle will make a second blast; this will be repeated by the third blast, and so on—all without confusion of signals.

The highest place in the world regularly inhabited is stated to be the Buddhist monastery, Halne, in Thibet, which is about 16,000 feet above sea level. The next highest is Galera, a railway station in Peru, which is located at a height of 15,635 feet. Near it, at the same level, a railway tunnel, 3,847 feet in length, is being driven through the mountains. The elevation of the city of Potosi, in Bolivia, is 13,330 feet; Cuzco, Peru, 11,380 feet; La Paz, Bolivia, 10,883 feet, and Leadville, Col., 10,025 feet.

Physical Tests of Materials.

The following is the standard test of materials that enter into the construction of a locomotive required and given by the Baldwin Locomotive Works, where the buyer has no pet test of his own.

All materials used in the construction of the locomotive shall be of the best quality of their respective kinds, carefully inspected, and subjected to the following tests. Notwithstanding these tests, should any defects be developed in working, the corresponding part will be rejected

All boiler-iron will be specified C. H No 1 flange quality, and must be made from the best charcoal blooms.

A careful examination will be made of every sheet, and none will be accepted that show mechanical defects.

A test piece to be furnished from each sheet, to be tested. Such test strips must show an ultimate tensile strength with the grain of not less than 50,000 pounds, an ultimate tensile strength across the grain of not less than 45,000 pounds, and must show a ductility, measured by elongation, of not less than 20 per cent. Should any of the test pieces fail to fulfill the above requirements, the corresponding sheet will be rejected

Should any plates develop defects in working, they will be rejected.

Each plate must be stamped with the maker's name and the guaranteed tensile strength and elongation as above.

A careful examination will be made of every sheet, and none will be accepted that show mechanical defects.

Test strips taken lengthwise from each sheet and without annealing should have a tensile strength of 55,000 pounds per square inch, and an elongation of 30 per cent., in section originally two inches long.

Sheets will not be accepted if the test shows a tensile strength less than 50,000 pounds, or greater than 65,000 pounds per square inch, nor if the elongation falls below 25 per cent.

Should any sheets develop defects in working, they will be rejected.

Copper plates for fire boxes must be rolled from best quality Lake Superior ingots; they must have a tensile strength of not less than 30,000 pounds per square inch, and an elongation of from 20 to 25 per cent., in section originally two inches long. Test strips must be furnished with each fire-box for testing.

Iron or steel for stay-bolts and braces must have an ultimate tensile strength of not more than 60,000 pounds nor less than 50,000 pounds per square inch, with an elongation of not less than 30 per cent., nor undergo a reduction of area of fractured section of more than 35 per cent.

Copper stay-bolts must be manufactured from the best Lake Superior ingots, they must have an ultimate tensile strength of not less than 30,000 pounds per square inch, and an elongation of from 20 to 25 per cent., in section originally two inches long.

All boiler tubes must be carefully inspected and be free from pit-holes or other imperfections. Each tube must be subjected to an internal hydraulic pressure of not less than 500 pounds per square inch by the manufacturers before delivery. They must be rolled accurately to the gauge furnished by the Baldwin Locomotive Works, filling the gauge to a plump fit. They must be expanded in the boiler without crack or flaw.

When tested, iron or steel tubes must show a tensile strength of not less than 55,000 pounds per square inch, and a ductility of not less than 15 per cent.

Tubes of brass or copper to be of uniform circumferential thickness and solid drawn; to be perfectly round, and to resist an internal hydraulic pressure of 800 pounds per square inch. From the tubes under test, a piece four inches long will be cut, annealed, sawn lengthwise, and doubled inside out without showing sign of cracks.

When annealed they must withstand flanging cold a flange ⅜ of an inch broad for 2 inch tubes without cracking. Copper tubes must withstand flanging hot as well as cold. Tubes other sizes than 2 inches diameter must flange to a width proportional to their diameter.

A piece 30 inches long, annealed and filled with rosin, must withstand being doubled until the extremities touch each other without showing defects.

A piece 30 inches long, not annealed, filled with rosin, and placed on supports 20 inches apart, must withstand bending to a deflection of 3 inches without showing defects.

Bar iron should have a tensile strength of 50,000 pounds per square inch, and an elongation of 20 per cent., in section originally two inches long. Iron will not be accepted if tensile strength falls below 48,000 pounds, nor if elongation is less than 15 per cent., nor if it shows a granular fracture.

Of approved make, and of following guaranteed mileage. For 28" wheels, 40,000 miles. For 30" wheels, 45,000 miles. For 33" wheels, 50,000 miles. Other sizes in proportion.

(Adopted by Joint Committee of Master Car Builders Association, American Railway Master Mechanics Association, and Association of Manufacturers of Chilled Car Wheels, November 21, 1889.)

Deficient mileage will be adjusted upon return of the defective wheel, or that part of same containing the defect causing withdrawal from service. Or, if preferred, wheels will be furnished subject to approved specification and drop test, without mileage guarantee.

The locomotives for the Chignecto Ship Railway are being supplied by the Canadian Locomotive and Engine Company. They are to have eight wheels coupled, and will be without bogies. The cylinders are 22 inches in diameter by 26-inch stroke. The boilers are to be 59 inches in diameter, with 250 two-inch tubes, having a heating surface of 1,741 square feet. The steam pressure is 175 pounds. The wheels are to be 47 inches in diameter, and the grate area 29 square feet. The tanks will have a capacity of 3,620 gallons, and with this on board the total weight of the engine will be 180,000 pounds, all of which will be available for adhesion. Two of these locomotives are to haul a vessel in a cradle over the distance of 17 miles, which separates the termini of the line, at a speed of 10 miles an hour. The cradle is to be carried on 120 four-wheel trucks, and the maximum total weight hauled will be 2,500 tons.—*Ex.*

The number of compound locomotives in use or in process of construction has increased between Nov 1, 1889, and Nov 1, 1890, from 580 to 1,034, according to a statement by Herr von Borries in the *Engineer*. The total number is divided as follows Germany, 430; England, including those built for South America and India, 523, Italy, 2, Russia, 32, Switzerland, 11; North America, 8; street railways, 28.—*Ex.*

Numerous answers to questions on air pump breakdowns, and other subjects, are received after the answer has been published. These, of course, are not used, though many are interesting, and often correct.

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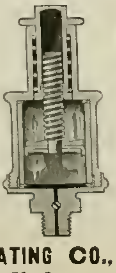

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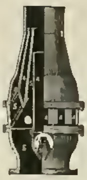

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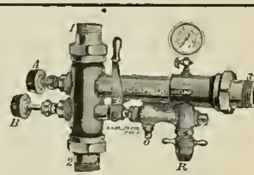

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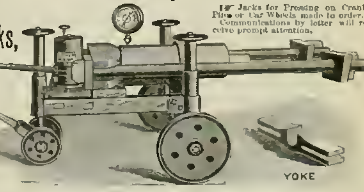

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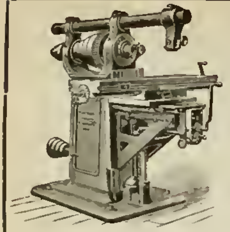

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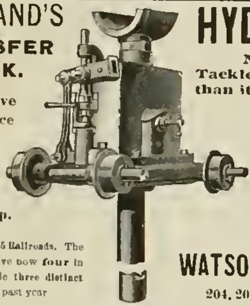

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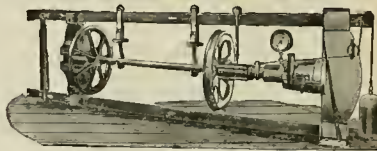

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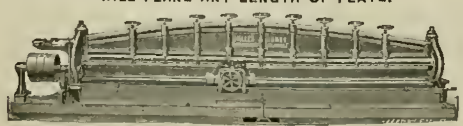

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Modern Heavy Switcher.

One of the best designed and most symmetrical switching engines to be found anywhere in this country is depicted in our engraving

This engine was designed and built by the Pittsburgh Locomotive Works for the Cincinnati, New Orleans & Texas Pacific R. R., and bears the initials of one of the leased lines. The general dimensions are as follows:

Cylinders, 18x24 inches.

Driving wheels, 50 inches diameter.

Wheel base, 10 feet 8 inches.

Weight in working order, 93,800 pounds.

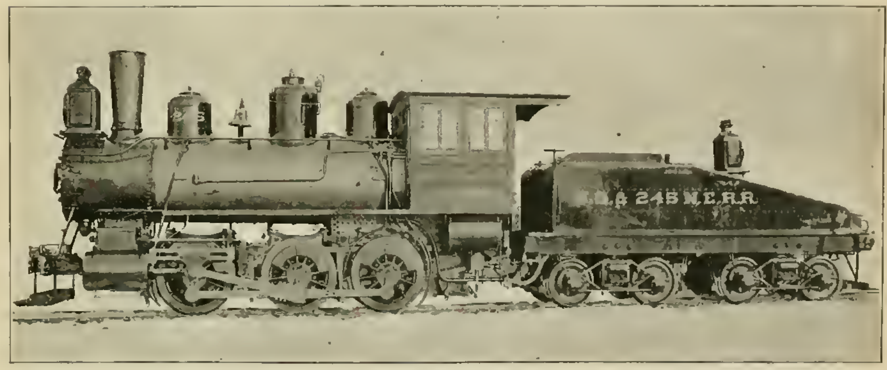
Diameter of boiler, 54 inches.

Number of flues 180; length, 9 feet 10 inches; diameter, 2 inches.

Fire-box, 90x34½ inches.

Tank, sloping, capacity 2,400 gallons.

For so heavy a six-wheeled switcher, there is the least overhang of weight at the ends, and the drivers are so arranged as to carry the load equally on each. The engine has an extended front, air-brakes, double sand-boxes and headlights, Laird guides and solid-ended rods. Every wheel under the engine and tender has a brake shoe on it.



MODERN HEAVY SWITCHER.

A Pair of Promotions.

E. M. Roberts, who has been our subscriber from the first issue of the paper, and who was formerly in charge of the Ashland Coal and Iron Company's railroad at Ashland, Ky., but has been more recently connected with the East Tennessee, Virginia & Georgia R R. at Atlanta, Ga., has taken charge of the machinery department of the South Carolina Railway, as superintendent of motive power, with headquarters at Charleston. Another of our early subscribers, W. J. Wilcox, has been promoted from his position as general foreman on the South Carolina Railway, to be master mechanic of the Charleston, Cincinnati & Chicago Railroad, with headquarters at Blacksburgh, S. C.

Mr. McNaughton, of the Wisconsin Central, has a very neat kink for showing the wear of eccentrics. He has a groove turned in the center of the face of eccentric, this groove is about an eighth of an inch wide, and half as deep. When the eccentric wears out of round—and they all do that—the depth of the groove shows plainly just where the wear has taken place.

High Speed on English Roads.

The railway companies running north by the West Coast lines have announced their intention to run the train leaving Euston at 8 P. M. for the north in twelve hours and five minutes to Aberdeen, instead of twelve hours fifty minutes. Just a year ago, the time of that train, which was then the fastest night train from London to the north, was fourteen hours from Euston to Aberdeen. In July, 1890, it was reduced to the time at which it now stands, hereafter it will, therefore, be only five minutes short of two hours less time from London to Aberdeen than it was only a year ago. Only a very few years ago twelve hours from London to Perth, 452 miles, by the West Coast route, was reckoned wonderful speed; but now 542 miles are to be covered within the twelve hours.

A Flying Trip Over the Northern Pacific.

(Editorial Correspondence.)

Nearly two years ago I wrote some notes on the Brainerd, Fargo and Mandan shops of the N P. road, but as my trip at that time only extended to the western boundary of North Dakota, the notes covered the eastern end of the great system for only 560 miles of the 4,160 operated.

The present trip has taken me across the continent to the tide-water of the great Pacific Ocean, and these notes are written at Portland, Oregon, instead of at New York.

As I have described the main shops of the system at Brainerd, and the next two division shops, we will skip them in the notes, just as I did in this trip, and commence where we left off eighteen months ago, at Dickinson, North Dakota.

I stopped at Dickinson, but knew beforehand that there were no shops there, but Dickinson is the headquarters of the superintendent of the Missouri division of the road, and I wanted to have a quiet chat with the man who sits in the superintendent's chair, not so much because I am stuck on superintendents, as a rule—I have seen the time when I avoided them—but because I want to keep track of the bright and progressive enginemen who get into such positions by sheer force of character, persistence and work.

J. E. Phelan commenced on this road as a fireman; he shoveled coal seven years, some of the time on the Lake Shore, then ran an engine for several years, was appointed traveling engineer, then master mechanic, and finally superintendent. He made himself conspicuously useful as an engineer, and attracted the attention of his superior officers, and made his name known the world over by his articles in THE LOCOMOTIVE ENGINEER on Air-brake Practice, afterward published in book form, reaching a third edition in a year, having been sold in every country where air-brakes are in use.

Mr. Phelan is not yet thirty-five years of age, and is undoubtedly one of the coming railroad men. He is sopping up experience in his present trying position, making few mistakes, and learning invaluable lessons for all made. There have been too many operative officers made of men totally without practical experience, and I am greatly interested in helping and encouraging every man who gets off a locomotive to assume an official position. I have before now called the attention of engineers to this matter, and asked them to go out of their way to encourage more of this kind of promotion by making these men successful; it helps engineers as a class, puts them in the line of promotion, and makes life less a burden.

The N. P. road from St. Paul to Brainerd runs northwest for 138 miles through a good agricultural country, then turns west, running across northern Minnesota and into North Dakota. Here the timber thins out, and the green opens and prairies give way to desolate looking stretches of land, good soil, but arid in a measure, and a land that has lured thousands to itself by grand promises of great yields, but has been prone to mock their patient labors about two years out of three. This spring, however, the Dakotas are verdant and prospects bright, but, well—wait till after harvest.

Western North Dakota lies higher, is more arid, and sage brush and bunch grass proclaim the northern fringe of Uncle Sam's great shawl—the plains. From Dickinson for a hundred miles or so west, the road traverses the "bad lands," named by the Indians. These lands are all their name implies, they support little vegetation, less water, game or domestic animals. Much of the territory is occupied by fantastically shaped mounds or hills, of rock and shale of a reddish or dirty yellow color, that has all the appearance of, and doubtless is, mud, hardened by the heat of the sun. Geologists tell us that all this vast territory was once the ground floor of some great sea that has been tideless and waveless, lo, these many years.

One of the first things a railroad man will notice on a trans-continental trip over the N. P. is the excessively heavy trains, the good condition of the splendid power and rolling stock, the steady grades, and the comparatively slow speed between stations; but if he is a thinker, he will think out a lesson on speed right here. The stations are far apart, and stops seldom made, so that by constantly pegging away, the great twelve car trains soon wear out the distance between St. Paul and Portland, 2,055 miles. It is getting away from stations that makes time.

There are but two through trains each way per day, but these are heavy enough to require double-headers, even on the prairies, when the wind blows.

The trains consist of three first-class vestibuled sleepers, one dining car, one colonist sleeper, two Pullman "tourist" sleepers, three coaches, and three mail and express cars. The sleepers and diner run through over the entire line, more than 2,000 miles. The tourist sleepers are something new, and must be a source of great comfort at little cost to people of moderate means. These cars, as operated by the Pullman Company, are fitted up complete with mattresses, pillows, blankets, clean bed linen, curtains, and carpet in the aisles. The toilet-rooms are fitted with wash stands, towels, soap, combs, brushes, etc., requiring nothing to be furnished by the passenger. A uniformed colored porter, with each Pullman car, is charged with the sole duty of looking after the comfort of patrons using these accommodations. A double berth in these cars will accommodate two persons comfortably. You can use one of these cars from St. Paul to Portland for $3. The colonist sleepers have upper and lower berths of ash, the berths or seats are not upholstered, and bedding is furnished by the passengers. A large range is provided, and a fire kept for the benefit of those who wish to cook on the car.

No stops are made for meals, but a ten minute stop is made at all division terminals, where the cars are inspected and the tanks filled. While such stops are made, a blue signal is displayed at the station, and it's "agin' the law" to move the train until the blue signal is removed and a bell rung. This insures safety to trainmen inspecting brakes and wheels.

On some of the comparatively level divisions, standard 8 wheelers pulled the train, but most of the way, 19x24 10-wheelers do the work. These engines are splendid machines, and are in good condition as a rule; they are comparatively new, however. Radial stay, wagon top or Sample boilers are used, and give splendid results. They carry bad water well, and are easy to keep clean; they have extension fronts and straight stacks. Over the Rocky and Cascade Mountains the trains are helped by 22x28 "hogs." I went to sleep somewhere in the bad lands of Eastern Montana, and when I awoke with the sun of another day shining behind the buttes of desert, the train was running through a beautiful valley, the grass green, the hills covered with timber, cattle and sheep grazing far and near, the Yellowstone River winding about the foot of the hills, and in the west, the bald, white peaks of the dear, grand old Rockies lifted their snowy crests above the clouds.

In a few minutes the train stopped at Livingston, where the largest shops on the road, except Brainerd shops, are located. I spent 24 hours there, and picked up a good many pointers that I shall give to the readers of THE LOCOMOTIVE ENGINEER when I can get some sketches made, and do the ingenious mechanics I found there full justice.

I will skip the shop notes, and merely outline the trip.

Livingston is the diverging point of the branch that runs down to the Yellowstone National Park, but this is not open for the season yet.

Leaving Livingston the grade is heavy, and a double-header is required until the summit is reached in Bozeman tunnel. The country is rough, but green in this section. At Logan, 1,056 miles west of St. Paul, a branch runs to the great mining town of Butte, fifty miles south of the main line. This branch runs on through Butte, and joins the main line again at Garrison, 134 miles further west. Half of the regular passenger trains run over this line, and the other half go over the northern track, via Helena. Helena and Butte are the first cities with move to them you find, they are prosperous mining centers. West of Helena a "hog" again leads the 10 wheeler up a 22-mile grade to the tunnel on Mullan Pass; then there are 100 miles of down grade to Missoula.

Timber becomes heavier as we go west, and vegetation is perceptibly heavier on the Pacific slope. The Rocky Mountains are not so high nor so rough in the north of the Union as they are in the south. Up in British America they lose much of their mountainous appearance, and are simply great tracts of elevated land. They get bolder and rougher as one goes south, until in Mexico they become volcanic. This can be seen in the difference in elevations reached by the different lines of road.

The highest point reached by the N. P. is 5,873 feet. This is but a little above the altitude of Denver, and the D. & R. G. reaches an elevation of more than 11,000 feet above the sea.

Skirting the northern base of the Bitter Root Mountains, the road traverses an interesting country, containing scenery of great beauty, but daylight struck on our train along here, and when I came to myself again we had crossed Northern Idaho and passed Spokane Falls, a hustling city of the new State of Washington, with half a dozen branches and lines of road of her own, and a couple of dozen on paper.

There are about one hundred miles of country in Eastern Washington that is pretty desolate and barren. There are some towns and some mines, and a few farms, but I think if I was in the business of making country I should have made this different.

At Pasco the road crosses the Columbia River on a long and high bridge, and at Ellensburg the road is in a grassy valley only 1,510 feet above the sea, and 1,784 miles west of St. Paul. From here the road commences to ascend the Cascade Mountains. The scenery is grand, water and waterfalls plentiful, vegetation growing rank, pines and fir trees upward of 200 feet high growing thickly all over the mountain sides.

The great train merely crawls up here, with its two big engines digging their toe nails in for all they are worth, but finally the great tunnel under Stampede Pass is reached. This tunnel was opened and timbered, and is now being arched with stone. It is nearly two miles long, being the second longest in North America, the Hoosac tunnel being the longest; it is lighted from end to end by incandescent electric lamps. This great hole pierces the range 2,885 feet above the sea, and has 1,105 feet of rock above it.

It is only 78 miles from this tunnel to the tide-water of Puget Sound, which the road reaches at Tacoma.

Here is a live, hustling city of 40,000 people, who are building up a metropolis of better structures, taking them on an average, than any eastern city. The road has a line running north to Seattle, Sedro and Anacortes, and to the extreme northwest point in the United States.

From Tacoma south for 147 miles, the road runs through a heavily timbered country, in which there are some signs of agricultural pursuits, and at last reaches its final western terminus at Portland, Oregon, the largest and finest coast city north of San Francisco.

There are enough people in Oregon and Washington to secure their admission into the Union as States, yet the country is so vast and the resources so boundless, that those who are here seem to make little impression on the country. The lumber business is one of the greatest industries, and the immense firs seem to invite the lumberman, and grow as rank and close together as weeds.

President Harrison visited Tacoma and Seattle a few days before I did, and the thrifty people killed two birds with one stone, by leaving up the arches built for him, and making them do service to welcome me. One of these was a timber arch, the side posts being two firs left with the bark on for about four feet from the ground, and then sawed square for ten feet. They were 36 inches square, not a knot to be seen, and the grain as straight as the saw cut.

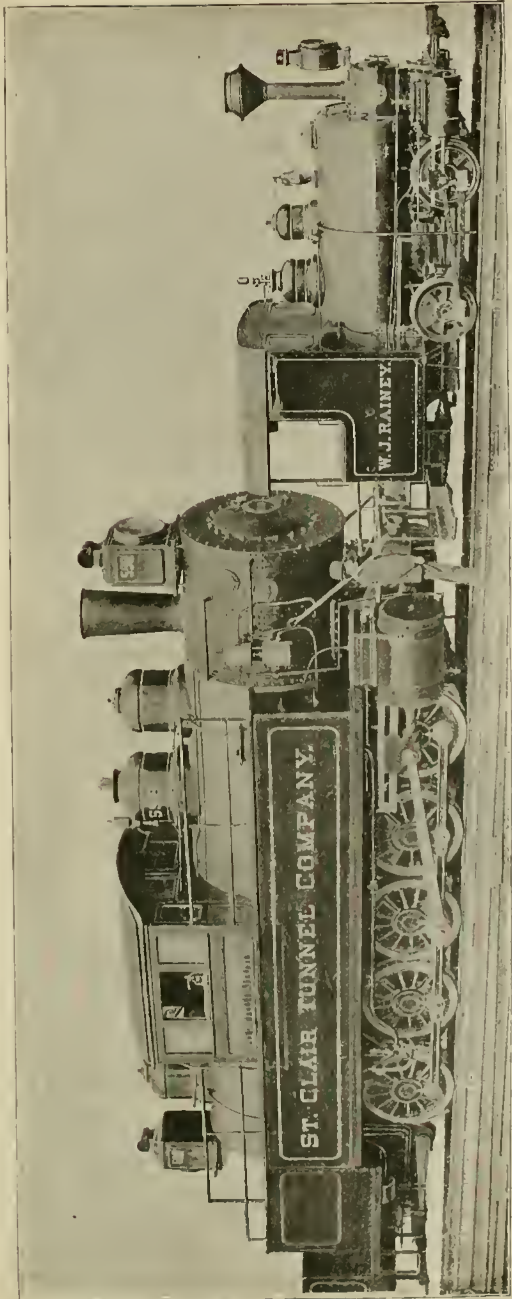
Another arch was composed of coal and coke. The coal is a fine quality of lignite, free from sulphur, and found inside of thirty miles from the city. On one of the floats of the parade was a single block of coal, weighing 16,800 pounds, without a seam in it. They made nearly 2,000,000 pounds of coke here last year. Wood is burned for most purposes; it is fat, and burns like rosin; it can be bought at retail for $2.50 per cord, and one of the local iron works pay $1.85 per cord in 1,000 cord contracts.

This is not an advertisement for Washington. If it was, I would go on, and tell you of its mining and agricultural advantages, but I will simply state that it is claimed, and it looks reasonable, that either Oregon or Washington has every resource that Pennsylvania has, and ten times as much of it.

One of the arches was composed of iron. An immense pile of ore, on either side of the street, made the foundation, and from this a ten-foot pillar of pig-iron was piled up, loghouse fashion, the ore came from the native hills only a few miles away, but the pig iron was imported from Scotland. Seattle is a larger town than Tacoma, has magnificent buildings, and a beautiful harbor and water front. Past her door or to it, come the ships of the Pacific ocean. Both of these cities are interlaced from center to circumference, by rapid transit lines of electric, cable or steam motor cars; these are fast, neat, and well patronized. I venture to say that one could go five miles in either town, while he went one in Philadelphia, or, barring the elevated road, in New York.

On the Columbia River the great industry is catching and canning salmon. The trains are ferried over this stream at Kalama, and enter Portland west of the river, ocean ships coming up the stream to the Portland docks.

The Northern Pacific road was, from the start, a stupendous undertaking. It cost millions of dollars to lay its iron way from the Mississippi to the Pacific for more than two thousand miles across arid plains, deserts, and over mountain passes; to



THE HEAVIEST LOCOMOTIVE IN THE WORLD.

aid the undertaking Congress gave them vast tracts of land, every other section on both sides of the track, I believe, and now there are many who want to cut down this grant, and take back the land.

By the building of this great road, a country before almost inaccessible, has been opened, and made habitable, and, if the consideration was to be land, they got little enough. The undertaking was stupendous, the expense enormous, and the traffic had to be created, for none existed before the road was built. For such service to the country a consideration something in proportion to the good done should be rendered.

This northwest coast country is a country of magnificent distances. A thousand miles, or so, is not far in Washington, Oregon or Northern California. This was impressed upon me this morning as I thoughtlessly stepped into the ticket office of the Southern Pacific Company to secure a sleeper ticket to Sacramento, and found that the capital of the golden State was only one thousand and ninety-four miles south, and San Francisco is ninety miles further. Yet people here talk of "taking a run down to 'Frisco," just as a New Yorker talks of going to Washington, or a Londoner of going up to Liverpool. J. A. H.

The Heaviest Locomotive in the World.

The large engraving shown herewith was made from a photograph, and represents one of four engines recently built by the Baldwin Works for the St Clair tunnel. The general dimensions are as follows:

Cylinders.... 22 in diam x 28 in stroke
Driving wheels .... 50 in diam
Driving wheel centers (cast iron) 44 in.
Tires (standard Otis steel). 3 in. thick
Tires, first, second, fourth and fifth pairs, flanged, 5½ in. wide; third pair, plain, 6 in. wide.
Tires secured by Mansell retaining rings
Tires, first and fifth pairs, 1 in play between rails, second and fourth, ¾ in play.
Boiler of ⅝ in. steel .. .. 74 in. diam.
Rivets . . 1 in diam, 2¾ and 3½ in. centers.
Laps—all longitudinal seams have double riveted butt joints, with double covering strips.
Steam pressure . . . . 160 lbs. per sq. in.
Tubes, 281, iron. .... . 2¼ in diam 13 ft 6 in. long.
Fire-box .... 132⅛ in long x 42⅛ in wide.
Water spaces . . 3 in. wide at sides, 4 in. at back
Firebrick arch supported by top bolts
Side screw stays, ⅞ in diam; crown screw stays, 1 in diam., riveted over at top and bottom
Grates .... Water tubes with drop bars.
Fuel Anthracite coal.
Crossheads of cast steel, with phosphor bronze bearings
Steam chest valves .. . . Balanced
Cylinder lubricators . Seibert sight feed
Injectors Two Friedman No 10 W F
Brakes—Westinghouse American, operated by air, on fronts of all wheels, with Ross-Meehan shoes.
Tank capacity, 1,600 galls (277 cu. in.) of water and 3 tons of coal
Wheel base total . . 18 ft 3 in.
Gauge of track 4 ft 8½ in
Weight on drivers in working order 195,000 lbs.
Steam bell ringer
Fuel, anthracite coal

These engines were designed to haul heavy freight trains through the new tunnel under the St. Clair River, between Sarnia, Ont, with Port Huron, Mich. The tunnel is 6,000 feet long, and the approaches are 1,950 and 2,500 respectively, the grade of the approaches being 105 feet per mile. For the work they have to do we consider them extraordinarily well designed. All weight is available for adhesion; there are no trucks and no need of any, as the engine will be employed on straight track most of the time. All the tires except the main ones are flanged.

The arrangement of the cab, in the center of the boiler and up where a man can see, is right, and this, with the side tank, should be the pattern for all heavy switchers, with perhaps a roof over the fireman's deck where soft coal is employed. This engine burns hard coal, so constant firing is not necessary.

The intention is that the engines shall not be turned around, as they will run equally well in either direction, two headlights and two sand-boxes are provided.

The boiler is the huge part of the machine, being 6 feet and 2 inches at the smallest ring. The engine backed up in front of the monster was one built on the same stall, and happened to be finished at the same time the 598 was. It shows the comparative size of the pusher to good advantage, and serves to show something of the diversity of design built at the Baldwin Works. Every wheel of this engine has a brake shoe on it, operated by air. The rails through the St. Clair tunnel weigh 100 pounds to the yard. These engines are capable of exerting a pull upon their draw bars of over 58,000 pounds, and were guaranteed to haul 760 long tons (2,240 pounds) up a two per cent. grade.

Butler's Rod Brass.

Master Mechanic L. M Butler, of the N. Y., P & B., had some trouble with broken bushings in solid-ended rods, and noticed that they always broke through the large hole for the set-screw, so he devised a new way of holding the bush.

He cuts a keyway in the strongest part of the stub end, as shown in the engraving A rib on the bushing fitting into this prevents its turning, and makes it necessary to cut only a small hole through it for oil.

The outside of the bush is cast as near the right size as is possible, and is then forced through a steel die that trims it off to the proper shape, a second die being used to perfect the fit.

This is as cheap as turning, and makes a first-class job of solid ends.

Wants Us To Have a Sure Thing.

In our April issue, under the above heading, we published a brief communication from a Wisconsin correspondent, who enclosed money to pay for 33 bound volumes of THE LOCOMOTIVE ENGINEER, and added the following pleasant suggestion:

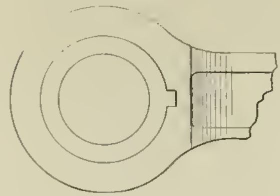
I think if the managers of our railroads would subscribe for your paper and furnish each engine crew with a copy, and have them receipt for them, same as the time card, it would be like bread cast upon the waters—it would return to them tenfold at the end of the year in net earnings for the company. If they would scatter them through the shops and roundhouses, and read them themselves, it would do some of them good. I send you eleven names, including myself, for three bound volumes each, for '88, '89, and '90. We all like it here.

The hint has certainly been taken by one railroad manager, for a few days ago we received from Gen. Supt. F. S. Gannon, of the Staten Island Rapid Transit Co., a list of 40 names of enginemen on his road to be placed on our mailing list as subscribers, the papers to go to their individual addresses, and the bill to the company.

While we hope no railroad man will go slow about subscribing because he hopes the company will save him the trouble of sending in his name, we shall place no fatal obstacles in the pathway of any other railroad managers who want to adopt Mr. Gannon's plan, when it will be recognized that increasing the efficiency of the men employed in the practical departments of a railroad is the surest path to dividends.

A Headlight Would Have Told the Tale.

In his report to the English Board of Trade on the collision which occurred on January 3d, at 12.19 P. M., at St. John's Wood-road station, Metropolitan Railway, Major-General Hutchinson says, "This very extraordinary collision was caused by an engine and brake van running backwards for at least 600 yards, down a steep incline of 1 in 60, in the tunnel between St. John's Wood road and Marlborough road stations, the driver, fireman, and guard being all under the impression that they were running forwards until they had again reached the mouth of the tunnel which they had entered about four minutes previously—too late to prevent the van from coming into collision, at a speed of five or six miles an hour, with the engine of a passenger train which was pulling up at St. John's Wood road station rather short of its regular stopping-place, the driver having noticed through the fog the brake van running back towards his engine. Charlton and the fireman were then both intently looking out for the home signal, 231 yards beyond the distant signal, Charlton giving the engine sufficient steam to keep it, as he thought, in forward motion, the reversing lever being in the second forward notch from mid-gear. Instead, however, of seeing the home signal, the engine must have first stopped and then gone backwards without either of them being in the least aware of it, and they were quite unconscious of what had taken place until the daylight at the St. John's Wood road end of the tunnel made them realize what had really happened. Charlton gave his evidence in a very truthful manner, and, extraordinary as it seems that he should not have noticed the stoppage of his engine before it began to go back, there is no good reason to disbelieve his statement or that of his fireman, which is much to the same effect as his own. The brakeman in the van had felt the engine stop, but had then thought that they had again gone forward, and was only aware of the retrograde motion when his brake van came to the St. John's Wood road end of the tunnel, too late for him to apply his brake." That the train should have run back down an incline for 600 yards, and that the driver, fireman and guard, all careful men, should have all been under the impression that it was running forward seems almost incredible; but there is every reason to believe the truthfulness of their evidence. Some means will have to be adopted to prevent similar accidents in future; a powerful lamp, throwing a strong light on the near wall of the tunnel, would, we think,



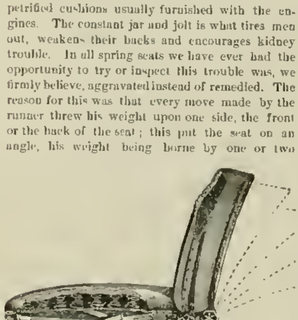
BUTLER'S ROD BRASS.

answer the purpose, and would have the recommendation of not being expensive.—*Railway Herald* (London)

Perhaps these men who honestly thought that they were going ahead when they were going backward, furnishes a clue to the reason some men think that their engine is slipping ahead when she is really slipping back or holding her wheels still.

A Platform Spring Cab Seat.

The contrivances that men rig up for themselves to take some of the jar off their backs on hard riding engines are a little better than the solid boxes and petrified cushions usually furnished with the engines. The constant jar and jolt is what tires men out, weakens their backs and encourages kidney trouble. In all spring seats we have ever had the opportunity to try or inspect this trouble was, we firmly believe, aggravated instead of remedied. The reason for this was that every move made by the runner threw his weight upon one side, the front or the back of the seat; this put the seat on an angle, his weight being borne by one or two



A PLATFORM SPRING CAB SEAT.

springs, and to maintain the position the muscles of the back were severely strained. Great care had to be taken to get "balanced," and more care to keep so. They were ungainly, especially in a drop seat form, and were made very uncomfortable by the breaking of one spring.

The seat here illustrated is the invention of a practical engineer, and has advantages over anything of the kind we have yet seen.

There is but one main spring, the cushion is full of small springs to make the seat soft, but the weight of the seat and the occupant is taken by the large central spring; the equalizing levers are hung from the seat corners to the base, being hung at the centers to the top of spring as shown, making a perfect platform spring seat. The entire weight can be placed on one corner or out of the center, yet the seat goes down level, and level only.

There is no forward and backward jerk, that is so tiring. The platform system of springs takes up all the side thrusts as well as the jumping motion.

The back is adjustable to any angle or can be instantly let down level with the seat where used on a "drop" seat. This back being fast to the seat, moves with it, and does not come and go like the old-fashioned back cushion that is fast to the cab with a spring seat under it.

The makers of this seat, Stannard & White, Appleton, Wis., are both engineers. They have named it the "Brotherhood" seat, and have been selling them for some time; they are extra well made and upholstered in leather; this is durable, and does not burn, or hold moisture or dust, as plush does.

The Railroad Side of the Question of Locomotive Standards.

It has been stated quite recently that, instead of working toward uniformity of locomotive design, the railroad master mechanics of the country appear to be demanding increased diversity of patterns. It is claimed that the reason for this lies in the fact that there is so much desire to impress the stamp of individuality upon the locomotives that few railroads follow the practice of accepting the builder's standard engine. It is quite possible that there is a greater diversity of design now than there was a few years ago, but we doubt if the true reason for this condition of affairs is the one referred to above. There is no doubt a desire among some master mechanics to do their own designing simply for the glory of it, and not because they have thought of a number of important features which are not to be found incorporated in designs already available; but, on the other hand, many of the designs made during the last few years have been the outcome of an attempt of each road to adopt standards for itself, with the idea of reducing the expenses of maintenance and repairs, and having the engines specially adapted to its own work

This policy of the railroads will doubtless become more marked as they consolidate into large systems, and their mechanical departments are managed with the greater efficiency which generally comes with the enlargement of the interests controlled by one management. This is a move in the proper direction, and is just exactly what a mechanical department should do, providing it has the good sense to adopt each feature of every design which becomes its standard simply because it is meritorious, and not because the idea originated with it.

Take any large system on which the entire mechanical department works as a unit, whose standards are adopted only after very careful consideration and discussion at meetings of its master mechanics, in which each man is free to express his opinion and tell his experience; should not they adhere to the standards so determined upon, even though it appears to the builder of locomotives as if they were causing him unnecessary labor by so doing? They will find it easier to maintain the engines than if every bidder had his own way and the road was finally equipped with a heterogeneous lot of locomotives. Providing a railroad has chosen its standard wisely, the question of conformity to, or variation from, its standard, when buying a lot of engines, may be stated thus: Will we have our own standard, so as to keep all our engines of this class alike, and thus facilitate repairs, etc., or will we accept the standard of the builders? If we do the latter it will be easier for the builder, but he constructs the engine in a few weeks or months, and we have it on hand from five to twenty years; will the slight reduction in first cost, which will come from accepting the builder's standard, pay us for the increased cost of maintenance?

So far as locomotive design and operation is concerned, each railroad is far more independent of others than is the case with its cars, and there is no call for its adopting other people's standards, except so far as they have been demonstrated to be better than its own. Of course it should never neglect to profit by the experience obtained by others, and in so far every mechanical department pervaded with the right spirit will look to others to see what they are doing. In this respect there can be no doubt but that some fail to improve their opportunities, and either remain ignorant of certain facts or learn by their own experience, when the knowledge could be gained from the experience of others.

We hear from time to time more or less about railroads making standards in locomotive work which shall be general, but something can be said on the other side. Do locomotive builders, for instance, take any steps toward achieving uniformity in their designs? Are not the locomotives turned out by the various builders in this country as their standards well known by special features which characterize their construction? We suspect that if an attempt were made to reduce the standard of the builders to a uniformity, they would be found to be just as slow in a move of this kind as the railroad men have been in the past. Without a great pressure is brought to bear, neither railroads nor builders will make their locomotive standards uniform, and where designs have been carefully considered before acceptance as standards there seems to be no reason why they should change them — *Railway Review.*

Locomotive Running Repairs.

By L. C. Hitchcock

SHOES AND WEDGES.

The subject of shoes and wedges in a general way might, perchance, come more properly under the head of general repairs, or back shop repairs, as it is quite frequently expressed.

However, it often occurs that work comes into the roundhouse which makes it necessary that the man who does the work should have a thorough knowledge of a correct way to line and fit up shoes and wedges, as practiced in the machine shop where engines go for general repairs. Right here let me say that I consider it a mistaken idea to suppose that most any kind of a workman is good enough for the roundhouse, as the class of workmen seen in some roundhouses would seem to indicate, for there is scarcely a day passes which does not bring to the roundhouses work which, if done quickly and in a proper manner, requires the brightest and best mechanics obtainable.

We will suppose that an engine with a broken driving brass comes into the roundhouse for repairs, and after the drivers are removed it may be found that the shoes, wedges and boxes are cut so badly as to necessitate facing. In a case of this kind it certainly would not pay to put in the driving brass and not repair the shoes and wedges. After having removed the boxes, and gotten the work started on the brasses, the attention should be directed to the shoes and wedges. There is a diversity of opinion in regard to the best way of lining these up, some claiming that they should be lined square with lines placed through the centers of the cylinders. Others say that it is better to work from the male engine truck center casting. I have observed that better results follow working in the last mentioned manner, provided that the male center casting is in an exact central position between the engine frames. The reason for this belief I will explain further on.

The first thing to be considered when starting to line up a set of shoes and wedges is the condition of the pedestal braces, and should these braces be bolted to the jaws as are those of the Baldwin and several other builds of engines, they should be bolted to place after the removal of the driving boxes, and care be taken that the slots in the braces closely fit the pedestals, or ends of the jaws. In case they do not fit they should be heated and the slots closed sufficiently to allow fitting with a coarse file. I consider it good policy to leave about $\frac{1}{32}$" space between the pedestals and bottoms of slots in brace after the brace has been drawn tight. This will allow the brace to again be drawn tight in case there is any wear on the sides of the slots in the braces. After the braces are fitted remove the driving springs and saddles, have the engine frames nicely cleaned, and give the face of each jaw a general bearing to a true surface plate. Now see that the center casting is centrally located between the engine frames. Should the shoes and wedges have liners in them they should be removed, and each shoe and wedge be placed in its proper position on the jaws, leaving the bottom of each wedge stand away from the pedestal brace about $\frac{1}{4}$", and block firmly each shoe and wedge to the face of the jaw. Now take two blocks of wood each about 3"x4" (*A*, Fig. 1), and of such length that, when they are placed in an upright position, one on each forward pedestal brace, their upper ends will be about on a level with the bottom of the center casting. On top of these blocks place flatwise a true wooden straight edge *B*, and block its edge firmly against the faces of the shoes with stick *C*. On the upper surface of straight edge get the exact central point between the engine frames, and using this point as a center, lay off the diameter of the center casting *D*, and notch the back edge of straight edge where these lines come. Then clean off the bottom part of the center casting and pass a fine line around it, and carry the ends back to the straight edge, tie a light weight to each end, and drop the lines into the notches mentioned. (See Fig. 2). Now see if the straight edge is square with each line. If it is not square with the lines, shims should be placed between one end of the straight edge and face of shoe until it comes square.

When shoes and wedges are squared from lines running through the centers of the cylinders the straight edge is used as just described. The difficulty which arises is that the cylinders are very seldom exactly in line with the engine frames, and where they are not it is impossible to get the straight edge square with both lines, and where an effort is made to do so, and the shoes and wedges are lined from the straight edge in this position, the drivers are not square with the engine frames and center casting. This will cause flange wear to driving and engine truck wheels. Then the latter method requires more labor, for it necessitates the removal of both pistons.

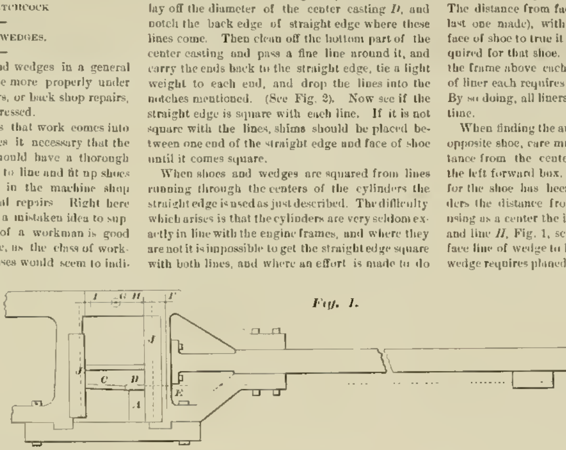


Fig. 1.

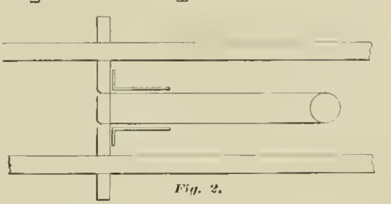


Fig. 2.

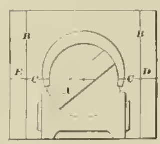


Fig. 3.

Now to return to our line around the center casting. When the straight edge is perfectly square with both lines make a prick-punch mark *E*, Fig. 1, on the outside of the forward jaw on each side of the engine, an equal distance from the face of straight edge and top of the frames, and with a pair of trams transfer these punch marks to the same points on the back jaws. Now through the first punch marks made scribe a line to, and square with the top of frames. Then scribe the face line of each shoe and wedge to the top of the frames, and at an equal distance from the top of each frame get the central point between the face lines and see if these central points are equally distant from the lines first scribed to top of frames. That is, see if the distances from lines *F* to points *G*, Fig. 1, are the same on each side of the engine. In case they are not equal, change the central points until they are equal.

After these central points on the forward jaws are placed exactly in line with the straight edge as described, and the central points between the face lines of the back shoes and wedges have been made, tram from the forward to back points on each side; the back points may have to be slightly changed to make these distances equal. The boxes should now be fitted to the journals, after which place a piece of wood *A*, Fig. 3, firmly between the brass and cellar, flush with the sides which bear against the wheel hubs when the boxes are in place. On these pieces of wood get the centers of the brasses, and transfer the shoe and wedge bearing faces of each box to the outside faces by scribing lines *B B*. Now scribe line *C* squarely across the last two lines, and passing through the center mark on the piece of wood. Fig. 3 represents the outside face of the right forward box. With a pair of dividers now space the distance from the center mark to punch mark *D*, and scribe this on the frame towards point *F*, using point *G* as a center. The distance from face line of shoe to line *H* (the last one made), with what is needed planed from face of shoe to true it up, is the amount of liner required for that shoe. It is a good plan to write on the frame above each shoe and wedge the amount of liner each requires as each amount is ascertained. By so doing, all liners may be cut out at the same time.

When finding the amount of liner required for the opposite shoe, care must be taken to space the distance from the center mark to punch mark *E* on the left forward box. After the amount of liner for the shoe has been found, space with the dividers the distance from punch marks *D* to *E*, and using as a center the intersection of horizontal line and line *H*, Fig. 1, scribe line *I*; the distance from face line of wedge to line *I*, together with what the wedge requires planed from face to true it up, is the amount of liner needed for that wedge.

After finding the amount of liner required for each shoe and wedge, take them down, cut out and fit each liner where it belongs; now replace the shoes and wedges on the jaws with the liners in them but not riveted, and place the straight edge in its former position; be very sure now that the distance from mark *E* to the straight edge is equal on each side, then scribe the lines *J J* down the frame and outside flange of each shoe and wedge, square with the top of frame. This mark should be made near enough to the face of each shoe and wedge to insure it being seen by the planer hand should he hold them in a chuck on the planer. Now with a pair of morphrodite calipers get the distance from the straight edge to lines *J* on the shoes, and scribe it from the straight edge on the inside flange of each shoe, then set the points of a pair of dividers to the lines *J J*, and taking the lines on the inside flange of the shoes for centers, scribe a line on the inside flange of each wedge, remove the straight edge now from the forward jaws, and block it to the shoes on the back jaws, and see that the distance is the same on each side from the straight edge to the marks which were transferred from the forward to the back jaws. Then from the straight edge lay off the inside of each back shoe, and wedge in exactly the same manner as just described for the forward ones. Now if each shoe and wedge is chucked on the planer to mark *J*, and mark on inside flange when finished, and then put in their places on the jaws, their faces will be square with the top of frames and the lines from the center casting. To insure that no more be planed from the faces than necessary, the distance should be given the planer hand from line *H* to *J* for each shoe, and from *I* to *J* for each wedge, and after the planing is done, lines *J* remain as proof lines, and will show whether the planing has been properly done or otherwise. After each shoe and wedge is planed, replace the liners in each just as they were when they were laid off, and rivet them there, using but two rivets near the top of each; liners riveted in this manner will not buckle as they will when more rivets are used.

After the liners are all riveted in, place each shoe and wedge in its proper position on the jaws, and block them firmly to face of jaws, and try if their faces are flush with lines *H* and *I*, are square with the top of frames, and parallel with each other; if so, give each a general bearing with a file to a true face-plate (use no scraper), after which true the shoe and wedge bearing faces of each box, using as a face-plate each shoe and wedge where it belongs in the box, they are then ready for service. If the directions as given are closely followed it will not be necessary to try the boxes in the jaws previous to wheeling the engine, and the wedges can be adjusted after the wheels are in place.

The Rock Island's latest passenger engines have crossheads, rockers and tumbling shaft of cast steel. The tumbling shaft and arms are all in one piece, require no machine work, but facing of bosses and pin-holes on arms and bearings turned. They are slightly heavier than wrought-iron, but do not look at all heavy. They were made by the Eureka Cast Steel Co., of Chester, Pa This class of work is destined to become very popular, as far better and cheaper parts can be had with less work, and running repairs cheapened.

The Latest in Composite Photography.

Angus Sinclair recently took a brand new Kodak camera on a trip through the South. He religiously "took a shot" at almost everything he saw. Angus knew enough to take off the cap, but he read the legend, "You press the button, we do the rest," and translated it literally He "pressed the button" some seventy-five times, but did not turn the key that moves the film along. The result is that the photo is of a combination order—sort of scrambled view—with a frog-pond from behind Knoxville lying on the side of one of the seven hills of Richmond, an East Tennessee compound going up a Chattanooga church spire, a magnolia tree growing out of the back of an Atlanta razor-backed hog, and a four-year-old pickaninny calmly holding Lookout Mountain in his hand.

The new sleepers on the Erie's limited trains between New York and Chicago have many improvements over the old standard Pullman. The smoking room is large and the wash-basins are located in it, leaving the end of the car, and the passage way clear, making it much pleasanter to go through, to and from the diner, as ladies do not have to go through a crowd of half-dressed men. The hand pump and marble slab basin are gone, and the basins and slab are of metal brightly nickeled, a simple lever turns on hot or cold water at will, the water for the car being delivered by air pressure. The cars are finished in mahogany, and plush to match, the usual curtain railing on each side of the car is absent, the rails and brackets folding back into the upper berth, giving the car a much more roomy appearance. The means of ventilation have been increased and improved; vestibules have made it harder to properly ventilate cars. The trains are lighted by the compressed gas system.

It is estimated that 60,000,000 ties, equivalent to more than 365,000,000 cubic feet of raw material, are used annually in railway repairs. From 13,000,000 to 20,000,000 are supposed to be used annually in new railway construction, making in the neighborhood of 80,000,000 ties consumed each year, at a cost of $30,000,000 to $35,000,000 The amount of money invested in railway ties under the 210,000 miles of main lines and sidings in this country would equal more capital than the combined capital of some of the largest industries extant, and it is estimated that more than 6,000,000 acres of forest lands would have to be cut to supply the necessary timber to furnish these ties. Oak is preferred over all other kinds of wood for ties, and it is claimed that about three-fourths of all in use are made from this hardy timber The remainder is divided mostly into pine, then into red, white and California cedar, chestnut, tamarack, hemlock, cypress and redwood.—*Ex.*

The Maryland Central road contemplate changing their gauge from three feet to standard. They operate eleven locomotives on eighty five miles of track

Correspondence

Not Happy Yet.

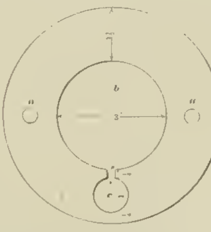
Editor The Locomotive Engineer:

Your answer to Question No. 32, in April issue, does not suit me. An engine is pulling twenty-five loads. She breaks off five and runs ahead with them. The throttle or lever not being touched, yet the exhaust is easier and lighter. You say the exhausts take place closer together. Why should they take place closer together when valve has same travel as it did before train broke? You say that after the engine has gained speed there is not the time for the cylinders to fill with steam that there is when moving slowly and cutting off so late in the stroke.

Remember that the steam is being cut off at the same point of stroke; it is not earlier or later. Cylinders getting half of the boiler pressure, and ports having the same opening, I thought that steam was quick enough to fill the cylinders.

Pine Bluff, Ark. WALTER HAMBLIN.

[The point of cut-off has nothing to do with the exhausts taking place closer together—it is the speed that fixes that. There are four exhausts to every revolution, and the engine may make one or one hundred revolutions in a minute. In this case she commences to increase speed the moment she breaks away from her train. Steam is quick enough to enter the ports at almost any speed, but at higher speed cannot fill them with so much pressure, because it does not have time]



Another Cause for Leaky Triples.

Editor The Locomotive Engineer:

The leak referred to in letter from A H. Tucker, in your April number, is not always caused by the emergency valve spring, as we have found from experience on the equipment at this place. A large number of the first quick-action triple valves had leather seats on the emergency valves, but they now make them of rubber, as the leather would not remain air-tight for any length of time. The leak caused by this gasket will blow continuously through the exhaust port of pressure-retaining valve.

If the trouble is not caused by this seat, I think E. Taylor (also letter in April number) will find the trouble in the large gasket between the triple valve and the auxiliary reservoir, where the "special" freight cylinder, reservoir and triple valve are used, same as plate *D* 34, catalogue 1890. In these there is a one inch passage from triple valve through the auxiliary reservoir to the brake cylinder, which leaves but a small portion of the gasket above the one-inch hole cut, to admit air to brake cylinder when brake is applied. This part of the gasket blows out frequently, and lets the air escape through the exhaust port of triple valve to the pressure-retaining valves, and there it will blow until the gasket is renewed Too much oil in the triple valve and brake cylinders helps to soften the rubber until it blows through; in cases of this kind the trainmen sometimes close the pressure-retaining valve to stop the leak, which, of course, keeps the brake set on that car. I enclose a sketch of gasket showing where it gives out, *a a* represents bolt holes, *b* to auxiliary reservoir, *c* one-inch air passage to cylinder, *x x* where gasket blows out. J. R. M.,

East Buffalo, N Y. Gen. Foreman.

Hot-air Pipes and Other Air-brake Pointers.

Editor Locomotive Engineer:

I cannot resist putting in a word about hot-air pipes in answer to F. B. A.

I have had this trouble with 6" pumps and believe it is due: First, to latent heat escaping from compressed air. For instance, at each stroke of the pump there is about 350 cubic inches of air reduced to twenty-eight or thirty inches. Now this air space contained so many units of heat, and after compression the heat escaped from the reduced space until its temperature was the same as its surroundings This heat had to go somewhere, and if it was not conducted away rapidly enough it would get the pipe hot next the pump, as that is the thinnest place, and would show heat sooner if the air outside was a bad conductor, as it is on a warm, dull, cloudy evening. To satisfy any one, let them feel a stream of escaping compressed air, and see how it will take the heat back again from whatever it touches until it reoccupies its original space. Second, in 6" pumps the passages were more liable to get stopped with gum causing heat by friction. Third, as the air got hot it expanded more, and the pump had so much more work to do in compressing thinner air or air with more resistance, on account of heat expansion, that it had to use more power to keep up pressure, and if the heat burned the gum out of the pipe, air would get out faster, and pump would cool if not too dry.

In the quick action triple valve with emergency stop it takes more pressure to release the brakes, as they have ten pounds more air on top of piston in triple valve, and the slide valve has the friction of ten pounds more pressure to resist the piston, and usually less air in train pipe to start them with than the plate D. 20 triple.

Another wrong theory, in my opinion, is that water will leak into pump from steam cylinder It will have to flow down a smooth piston rod at atmospheric pressure through packing that will hold one hundred pounds of air or more, and I do not believe that is possible. I think that the water deposits from the air under pressure, and then only under certain conditions, and not necessarily on damp or wet days; but when air is taking up water or drying things it will deposit faster, and when it is giving water up, the pipes will be comparatively dry, so when my tobacco is dry I watch the drain cocks closer.

Another bad thing, in my opinion, is the term "excess pressure" When I get on an engine to instruct an engineer I try to find if he calls it "excess." If so I generally find him carrying his brake handle in release. If he calls it reserve he uses the running position. As an illustration: If the engineer had one hundred dollars laid by, it might be an excess to his employer, as may be the reservoir pressure to the man who doesn't run, but the engineer relies on the money as a reserve, and should not be misled to such an extent as he usually is in the other case by the term "excess pressure."

I have found it to be of great advantage to me to keep a small test gauge and thermometer, and believe that it would help explain many things that, without them, are apparent contradictions to correct air-brake practice

Would be very much pleased to learn what conclusions others have arrived at in these matters.

Roanoke, Va. GEORGE HOLMES.

Traveling Cranes in Locomotive Repair Shops.

Editor The Locomotive Engineer:

I wish to take up your editorial in the April LOCOMOTIVE ENGINEER, arguing against the use of traveling cranes in locomotive repair shops, and correct some statements which you make there.

We have, in our shop here, an electric traveling crane, made by the Shaw Electric Crane Company, Milwaukee, Wis., which has a capacity of 50 tons, and has been tested to 60 tons.

This crane travels over all the pits, from end to end of the machine shop, and it is run from a dynamo placed in our engine-room, which is belted to a pulley run by a clutch, fastened to the main line shafting, so that we do not run the dynamo, except when we want to use the crane. This answers your argument—that traveling cranes require power at all times, whether in use or not.

We have an electrician who takes charge of our five dynamos, keeps in repair all of our electric lights, and both of our electric transfer tables and runs these and our electric crane, when necessary, and his services would be required for the lights and electric transfer tables if we did not have the crane, therefore it cannot be said that the crane requires a man in attendance all the time.

The amount of repairs which this crane has required in the past nine months would not amount to $10 altogether, and the amount of oil used is very small indeed.

Our crane occupies no floor room whatever, and is not in the way of any belting or machinery, and I will guarantee that we can take an engine off its wheels, or put one on its wheels, in one-twentieth the time that the same work can be done on the drop tables. For example, we regularly remove the wheels from our heavy ten-wheel engines (weighing 63 tons in running order), in ten minutes, and less, from the time the engine is ready to raise until it is resting on the blocking, and can do it, on a wager, in five minutes. To do this same work with a drop table, and get the engine back into place on the pit, on which it is stripped, cannot be done in much less than two hours, as I know by experience.

If you take a trip this way we shall be more than pleased to prove to you the above statements, and show you the fine plant we have here, which, for its size, is not surpassed in the United States.

M. K. BARNUM,
Superintendent of Shops, Union Pacific R. R.
Cheyenne, Wyo.

The Whistle and Lamp Business—Water-brakes.

Editor The Locomotive Engineer:

Some of the boys seem to be much worried over the whistle and lamp business, or why the whistle blows out the gauge lamp.

Sound is produced by the vibration of air. Flames, under certain conditions, are very sensitive to these vibrations, and when the small lamp flame is exposed to the sound from steam whistle, it is simply "shook out." Every tone of sound, from bass to shrill, gives a different vibration, or, in other words, produces a "sound wave" of different length. When the flame of certain length or breadth is struck, as it were, by a certain sound that vibrates it, if the flame is sensitive to that particular sound it won't stand that shaking up, as it were, and will go out.

The only way to keep the lamp lighted is to change burner to get a different size flame, or change whistle to get different tone. Another way might do to change position, or protect lamp flame, so that the sound waves won't strike it so hard. Many remarkable effects are produced on thin and delicate flames by different sounds, as scientific experiments have shown.

The action of whistle on cab lights is simply mechanical, and done through the air. There is no hoodoo about it.

Concerning the water-brake, it becomes interesting when our friend talks about how "she shoots water out of her exhaust nozzles into the front end with the cylinder cocks closed." This sounds like the engine that wouldn't suck her ashes. There will be trouble on the Deadwood Central if they don't open their cylinder cocks and quit letting in so much water. The water gets into front end because too much is admitted to exhaust passage, and at the moment the valve closes, it "back acts" out the nozzle. No more water should be admitted than will destroy the vacuum in cylinder, caused by the reverse action, without "sucking ashes" from smoke-box, lubricating the moving parts, besides doing its main duty, that of creating back pressure on pistons, and holding the engine back, making it a valuable aid to other braking appliances.

We use the water-brake constantly on descending certain grades, consolidated engines having made nearly half their mileage in the past four years with water-brake applied, and there is no indication of unusual wear on cylinders or valves, neither has any accident or breakage occurred from its use. Our cylinder cocks are of a pattern as large as an inch globe valve nearly, and kick up considerable dirt along the road, which is about all the trouble we have. Cocks are always open when water-brakes are applied.

Would be very glad to hear of any experience in regard to it.

DOC.

Dunsmuir, Cal.

Coal Burning.

Editor The Locomotive Engineer:

My friend "Doc," met me the other day, and turned a few ideas loose on coal burning, which you may wish to hear. We got to talking of the time back in '70 and '71 ("Doc" always likes to talk about old times), when we both fired wood; very naturally the talk worked around onto coal for fuel. He said: "When you and I got a dollar and a half for a day's work firing wood, and put in as much more time scouring the brass, washing the cab, and keeping things neat and clean, as we spent on the road, we were regular kings. Why, my engine had as much brass on her, outside her cab, as there is on fifty engines to-day. If a fellow run across a brass acorn in a junk shop or pile of scrap brass, he gobbled onto it and hunted for a bolt to screw it on, where it could be polished up and shine. Those days are gone now, and I ain't sorry. To-day there ain't a bit of brass in sight on my engine, even the bell is painted black. My fire boy has put some kind of stuff on the brass in the cab—I guess it is sulphur—that turned it black as jet, and he keeps it wiped off, so it shines like a black bottle. In the old days they did not pay any attention to how much fuel you burned. If a big pile was used up every trip, that was your bad luck, they never seemed to think of the cost, it was *git there* and *pull cars*. *Now* they have found out that coal costs money, and if the engines will do the work on less coal, there is so much less to be paid out for it. I believe it is a good sign, for the next thing they find out will be that it costs the company more to burn poor, dirty coal at a low price than to pay a fair price for good coal. It costs just as much to haul a car of poor coal 300 miles as a car of good, and handling it from the mine to the tender is the big end of the expense. I could fix my engine so she would burn a quarter less coal if we got good all the time, but about once in ten days—sometimes as long as a month—I get a tender full of fine dirt coal, so the nozzle and extension front have got to be fixed to make steam with that stuff. The rest of the time she chaws up good coal like sin; our square fire-boxes are too small to do a good job on poor material.

"Some of the firemen make you tired, too; they load her up with about six or eight scoops of coal just as it comes, some of it chunks as big as your head, then they climb up on their perch, and think they are 'getting there.' The other day I had one of them black smoke fellows. The conductor came ahead with orders once, and said: 'Doc, when you shut off we can't see in the coaches for smoke.' The boy says to me—that shows how much he knows—'You can't fire an engine without making smoke; if the smoke quits coming out of the stack she won't steam.'

"It is a blessing that he is the only one of the kind we have got on the road. I shook him at the end of the trip, and he is on a yard engine now, where he can't do much hurt. My regular fireman will keep her hot all day, and she never makes any smoke to hurt—just a little each fire that he puts in. I see to keeping a good arch in her, and he attends to the rest. He puts in one to three scoops at a time, and don't fire any oftener than the fellow that puts in twice as much at a time. When he first came on with me he used to spend about half of his time cracking coal, and would not put a chunk bigger than your fist into her. I asked him why he did it, he said the engine would not keep hot on coarse feed. She used to burn eight ton on the round trip, and never was what you could call a good steamer, now she takes five and a half to six ton, and is a daisy. I have made up more time on the fast run since I got him than anybody else, he ought to have the credit of it. She is always within about five pounds of blowing off, and stays right there, so I can hook her up in six inches, and whale the stuffing out of four cars, or nine inches with night express, which has nine cars mostly, when ever we are late, which seems to happen every day; some of the fellers on the other division don't seem to care about getting in on time.

"But that boy of mine is a dandy. I begin to believe what you told me last fall—that knowledge always helps out muscle. He hain't got much muscle, but he is way up on knowledge. Our traveling engineer is always asking the boys hard questions. I guess he don't know how hard it is to answer some of them. I told him so a while ago; he laughed, and said it didn't hurt anybody to have to rustle around and learn about his trade. Well, as I was saying, when they run up against a hard question they come over to my boy, and he gets out his books and talks about combustion, leverage, expansion, lap and lead, till you can't rest. I never knew but one other fellow just like him. He is master mechanic of a big road now, and I am a common plug puller. It is curious how some men take an interest in such things, and get good soft jobs out of it."

"Doc" is about right about some of his ideas. There is a closer watch kept of the fuel account now than ten years ago. The engines are expected to draw larger trains at faster speed than they used to; lots of them do not burn any more fuel in doing more work, while a good many engines haul a train of 60,000 pound cars, and use less coal than we did fifteen years ago with the same number of small cars. It pays to keep a close watch of the coal pile, it is the heaviest bill, next to wages, in the expense account of locomotives. He don't say so, but he seems to think that the fireman is responsible for all the coal that is wasted. He is way off there. If the engine is not worked evenly, pumped evenly, and a regular speed kept up between stations where the grades will admit of it, the close fireman wastes his skill. No amount of skill on the part of the fireman will avail, if the engine is worked hard out of one station with the injector full on, and easy out of the next one, and water level getting lower every mile. It takes coal to make up time; if lost time is all made up in a few miles, instead of spreading it out all the way to next meeting point, the coal pile will suffer. Both men on an engine have to do their best on a poor steamer to get over the road on time. What helps a poor steamer will make a good one better, and cut down her coal bill considerably, let alone the comfort you have working her. But you will hear it said, "You don't have to be particular about that engine, she will steam—just throw it into her any way." Maybe so.

CLINTON B. CONGER.

Grand Rapids, Mich.

"Please Note my Exceptions."

Editor The Locomotive Engineer:

In writing on the question of "Better Engineers," your correspondent makes use of some statements and insinuations that, in my judgment, need correcting, if not plainly rebuking. He says, "The great mistake has been in not recognizing the fireman as the future engineer." This statement is a mistake, to call it by its mildest appellation. A very large per cent. of the engineers on the "Milwaukee" road have been promoted from firemen. That they entered the service with the expectation of becoming engineers, and that the company intended, when they employed them as firemen, to so promote them, provided they could stand the most exacting of all tests—practical experience—no one familiar with the practice of this company will deny. What is true in this regard, of the "Milwaukee," is true of a majority of the roads in this country. The engineers themselves have always "recognized the fireman as the future engineer," as can be very conclusively proven. The fact is that the fireman has been so recognized by every one intimately connected with the railway service since a very early date in its development. And if he had not been so recognized Mr. "Sense" would have seen a very different class of men in the service as firemen, either now or ten years ago. Now, after men had entered the service under the operation of this custom, it would be manifestly unjust at a later day to "*weed them out*," because they might not be able to pass an examination that the company may have seen fit to adopt.

After a man has rendered faithful, careful, safe and acceptable service from three to thirty years, according to the capacity in which he is employed, it is not strange that men who are in every way competent to judge, and who have known him all through the trying ordeal, should refuse to accept anybody's statement that the man is incompetent.

The insinuation that either of the Brotherhoods is a repository for incompetents, or a veil behind which they hide, is a libel, the animus of which some one in the vicinity of Jamestown, S. D., may understand, but which I am unable to surmise. It's not to be wondered at that the author of such an imputation should hide behind a *nom de plume*, and have the concentrated "gall" to sign himself "Common Sense."

I can't say that I exactly like the tone of this communication for a mechanical journal, but if you allow one writer a dig at the Brotherhoods, you certainly can't refuse to let a Brotherhood man resent it. A. H. TUCKER.

Chillicothe, Mo.

The Air-brake as She is Writ About.

Editor The Locomotive Engineer:

I notice a great deal of discussion going on in your valuable paper relative to air-brakes, and it is a mystery to me how correspondents take upon themselves such weighty subjects without knowing the first principles of the subject on which they write. For a long time I thought I knew just a little bit about air, but after reading the enclosed article, cut from a magazine, I find that I do not understand the first principles. This may be a "chestnut" to a great many, but it is the first time I have seen it, and thinking perhaps it might be the means of setting your correspondents right, I send it to you. Wishing success in your endeavor to supply a good readable paper chuck full of desirable information,

I am yours truly,

C. T. McELVANEY,

Ass't Master Mechanic M., K. & T. R'y.

Denison, Tex.

The article referred to by our correspondent is entitled, "How Air-brakes Work," and reads as follows:

"Some of our older readers can remember the time when the 'brakemen' had something more to do than help women off and on the cars and mangle the names of stations. In those early days the stopping of the train was attended with shrill whistling, frantic twisting and straining at the brake-wheels, and a squeaking of the slowly acting apparatus beneath the cars. Now the train glides at almost full speed to the station and suddenly and smoothly stops within its own length.

"What makes the difference? 'Oh, we have air-brakes nowadays,' you say. True enough, and it is about these very air-brakes that we want to have a chat, for we half suspect that you, dear reader, have a general, not to say hazy, idea of the way in which these brakes are worked.

"The first air-brake was called the 'vacuum' brake. Under each car was placed a cylinder with flexible rubber sides. It looked like an accordion, and was connected with the locomotive, which operated an air-pump.

"In order to stop the train air was pumped into the cylinders, which were expanded, and by means of iron rods and levers pressed the brakes against the edges of the wheels. When the air was released the brakes were withdrawn.

"The 'Westinghouse air-brake,' now in general use in this country, England and the continent, acts on just the opposite principle. The flexible accordions are replaced by heavy iron cylinders, in the ends of which are pistons. The rods of the piston are connected with the brake beams. By means of very strong steel springs the brakes are drawn tightly against the wheels, so that unless they are pulled back the brakes are constantly 'on.' The pulling back is accomplished by pumping the air out of the iron cylinders; this draws the end pistons in and pulls the brake beams away from the wheels. It will be readily seen that this brake is greatly superior to the other form. The first is always 'off' unless forced 'on,' the second always 'on' unless forced 'off.' So in case the train is broken in two the rubber connection is at once broken, the air rushes into the cylinders, down go the brakes, and the cars stop.

"There are levers and cords in every car by which a little child can put on brakes the whole length of the train, simply by letting air into the vacuums of the cylinders.

"The air-pump is on the side of the locomotive, and looks like two large collar boxes with a piston working in and out between them. The pump is always at work while the train stands at the station, pumping the air out of the cylinders, and drawing back the brakes ready for the start. Next time you have a chance, look over the air-brake apparatus and fix these every-day facts in your mind. There are many interesting things connected with very familiar objects, and the more we know about them the better."

Darkening Headlights for Signals.

Editor The Locomotive Engineer:

It has been said that on some roads, at all meeting points for trains, the head and all train lights must be darkened on the trains in side track; curtains have been invented to shroud headlights on engines while standing on side track. What is the advantage of this system?

In the writer's experience, when making a meet, on the last minute, and not wanting to stop, to *see the headlight* of the other engine on the side track, and to know they are in out of the way, is a great deal more satisfactory than to go feeling your way through the yard on an uncertainty, and more particularly if the meeting place is on a curve; if they are not there the place is dark; if they are there, and all lights shrouded, the place is dark and everything uncertain. Headlights go out sometimes; suppose you are making a meet with a man who is always on time, it is dark and stormy, your headlight has gone out by virtue of a bird flying against the glass and breaking it, or any similar cause. As everything is dark at the station, you take it for granted they are on the side track, and pull through; but they got laid out and did not make it; your watch is two or three minutes fast from some unexplained reason, and you meet on that curve in the cut—you know the rest. If your headlight had not gone out, there is a possibility you would have known to a certainty that they were not in the side track; if they had been there, and all lights burning, everything would have been safe. Brethren, let us have light. W. DE SANNO.

Corry, Pa.

Locomotive Engineers—Present and Future.

Editor The Locomotive Engineer:

I have noticed for some time past that it is quite the thing—not only in your paper, but in other R. R. publications—for correspondents to criticise in very strong language ignorance in engineers.

I do not know why this is done, or what object they have in view by pursuing this course. Would they have the public believe that the ranks are filled with ignorant, and, consequently, incompetent men? That officials, high in authority, would countenance such dense ignorance as is portrayed by some of these writers? That they would trust not only valuable property, but human lives, in the hands of men who have no idea of how it should be managed?

To create such an impression would not only lower the engineers in the estimation of the public, but it would have a tendency to reflect against the management of a corporation that would place a premium on ignorance by advancing such men to positions of trust. Through all the tirade of abuse that has been heaped upon them, I am unable to recall one instance where it has been resented. Perhaps it is because the "mud throwers" hid behind an *incognito*—as they always do—or possibly they may have thought it unworthy of their notice and treated it with silent contempt. Be that as it may, I thought I would like to say something in their defense.

I am brought in personal contact with many engineers, and, as far as I am capable of judging, they are the superior in intelligence to any class of skilled labor I know of.

We do not, nor do we expect to find many of them who are scientists, mathematicians or graduates of the higher institutions of learning; but we do find men of good common sense, sound judgment, quick perception and excellent reasoning faculties—men who are perhaps able to give points to writers who are afraid to be known in print.

I remember of hearing a superintendent of motive power of one of our largest R. R. systems in the West say that he owed much of his success—as far as operating locomotives was concerned—to knowledge obtained by conversing with engineers. Now, how could or how can any of the so-called densely ignorant engineers diffuse light or knowledge of any kind whatever?

We cannot deny there are some who have missed their calling; were promoted, not because of their peculiar fitness for the position, or that they merited it in any way, but by reason of seniority, a pull with the powers that be, or various other reasons. Thus it is that there are some incompetent engineers. No doubt some roads do, even in this advanced age, employ men as firemen who scarcely have the rudiments of an education. They learn intuitively how to perform their various duties, and in time how to start and stop a locomotive, how to regulate the water feed, and how to "tie up" in case of a breakdown. They have never given the matter any special thought or study, because they have not the mental ability to grasp it. They could enlighten themselves on many subjects if they would devote a small portion of their leisure time to reading suitable books; but to these men reading is distasteful and irksome. They have no use for book knowledge; they feel their weakness, but cannot apply the remedy. Invariably, in every case, they can be blamed for their ignorance, but can you blame them for being engineers? I should say not.

There is one very dangerous shoal for the young engineer to pass. To illustrate: A young man is graduated from college as a physician or lawyer, and receives his sheepskin; but, if he would succeed in his chosen profession he must not rely wholly upon his college record, he must keep up with the times, and still devote much time to study and research.

A young man is graduated from a technical school and writes three or four letters after his name, but if he stops here he will get left. He must keep abreast with our nineteenth century hustlers or be relegated to the rear of the procession with the drones.

Again: A young man has been firing a number of years, has an excellent record, is bright, intelligent, and quick to "catch on." He at last reaches the height of his ambition, through merit, and becomes an engineer. As a fireman he was of an investigating turn of mind, would ask to be enlightened on subjects that he did not understand, but now that he is an engineer he is above asking questions, because an engineer should know almost everything. This young man has ceased to be progressive. "Got there," as it were, and now he is going to take things easy.

He has lapsed into sort of a comatose state, and, if he does not awaken, some one will pass him, and in a few years he will find himself in the rear rank.

Every trade and profession is burdened with weak material, and there is always room at the top for those who desire to get there, and are willing to work and sacrifice something for it.

I believe the time is not far distant when mechanical officers of railroad companies will realize the necessity of abolishing the rights of seniority, and adopting a system of written examinations, whereby they can determine qualifications and fitness for so responsible a position. Until some such course is pursued, there will certainly some creep in who will not raise the standard of intelligence among our engineers. Nevertheless, I do not perceive the benefit to be derived from constantly hammering at them, and holding them up for ridicule before the whole railroad world. The corporations that have poor engineers must endure them, and the only solution of the problem that I see is for them to be careful who they promote in the future.

Albany, N. Y. T. B. PURVES, JR.

Varnishing Car Sashes and Blinds.

The great puzzle is to keep blinds in proper condition when it is a necessity to revarnish the exterior of a car once a year, and not a necessity to revarnish the interior oftener than once in three years, and the blinds stand right in the gap between these two extremities. Really, the outside of a blind, especially the lower half, needs varnishing as often as the outside of the car does, but you cannot well do one side of a blind without doing the other, as the varnish runs through, and if you should do the blind all over as often as that it would become overloaded, and the inside would crack up like a turtle shell. The only conclusion is, then, to revarnish the interior of the cars as often as good judgment would seem to dictate, taking into thought the durability of the blinds—say once in three years—and then all can be done together, blinds and all, unless the blinds are dispensed with and curtains used, which, to our mind, is the best solution of the whole trouble.

Another thing as to sash: The glass should be thoroughly bedded with good putty into the sash, and the beaded side put on the inside of the car. This is important to keep the rain from running down on the glass between the bead and the glass, and soaking into the wood and driving off the varnish. You will notice that varnish is the first to leave the sash when the water gets in.—C. E COPP, in *Painters' Magazine.*

The Mason Regulator Co., of Boston, have acquired the exclusive right to manufacture and sell the piston throw indicator for air-brakes, patented by Mr. Frank Robinson, of Bangor Mr. Robinson is the master mechanic of the Maine Central R R., and this device was invented by him for use on railroad cars. It is perfectly simple, and indicates at any time to a car inspector the condition of the piston of the air-brakes. The Mason Co. will soon have description and catalogues ready for distribution.

We are always glad to change the address of any subscriber, no matter how often he moves; but it would save us a lot of trouble if, when writing for a change, you state whose club, if any, you were in. THE LOCOMOTIVE ENGINEER has by far the largest club list of the railroad papers, and the larger it gets, the harder to find a single name if classified in among the clubs.

In putting in new flues let the fire-box end project through the sheet a distance equal to two and a half times the thickness of the tube; this will be just right for beading down. If it is less than twice the thickness of tube, take it out; it will cause trouble.

The Austrian railway companies have been requested by the government not to engage any more foreigners for service on the railways, particularly in the administrative departments. Foreigners who are at present employed will be compelled to become Austrians or Hungarians within one year, if they desire to remain in the service This action of the government is based upon military reasons.

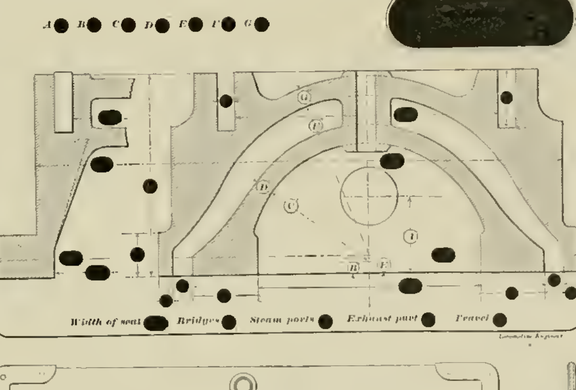
The Dixon Crucible Company, of Jersey City, have received a letter from Master Mechanic David Brown, of the D., L. & W., at Scranton, Pa, in which he says:

I can now give you an answer in regard to your pipe joint grease I consider it an excellent grease for mud plugs in locomotive boilers. The plugs come out easily, and when taken out are clean. We will order some on our next requisition, and use it hereafter.

New System of Shop Card Drawings.

At the shops of the estate of F. W. Richardson, Troy, N. Y., they make hundreds of locomotive valves every month; both the Richardson balanced valve and the Allen-Richardson. There are hardly two roads in the country that use valves of exactly the same dimensions, and it has been the practice in this shop to make a complete drawing for each order. This took time and cost money.

Superintendent W. S. Rogers has devised a scheme to avoid making drawings, and at the same time preserve a complete file of orders filled with drawings for use in case of a duplicate order. He has a holder to preserve the drawing from mutilation, which is shown in Figs. 1 and 2, and is described as follows:



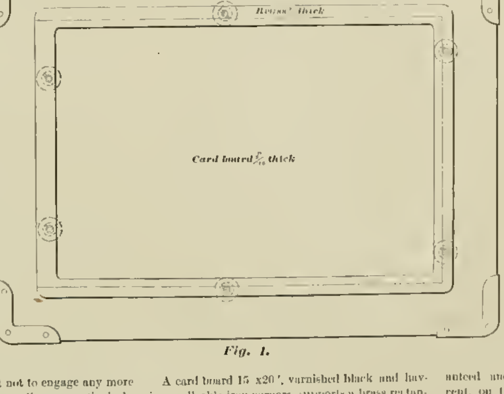


Fig. 1.

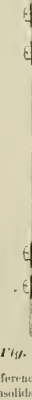


Fig. 2.

A card board 15 x20", varnished black and having malleable iron corners, supports a brass rectangular frame 11¼" wide by 16¼ long over all, and ⅛" thick by ⅞" wide. This frame is held to the card board by six screws, carrying washers at suitable distances apart, the frame being tapped for that purpose A grommet is put in top edge of card, that it may be hung up instead of lying on the bench on machine or getting on the floor.

Blue prints on cloth of the Richardson and Allen-Richardson balanced slide valves, with dimensions left blank as shown in cut, are kept in stock, the prints being cut to a standard size, as shown by the dash and dot line in Fig 1.

When an order comes in the office the dimensions are filled in on blue print, all dimensions for shop use being in heavy black ink—all other data being recorded in its proper place in red ink. The print is then slipped under the brass frame on the card and sent into the shop. After the order is filled the print is removed and filed away in alphabetical order in Shannon letter files especially made for this purpose, to be brought out again when duplicates are ordered. This system does away with the cumbersome varnished drawing card methods for each and every job.

This plan is, of course, of especial use in a manufacturing plant where many things of the same general form are used, but the plan can be adopted in railroad shops for a great deal of work, and much time and expense saved

Two of the Great Railroads of the World.

The Pennsylvania Company's system of railroads is composed of no less than 120 corporations, certainly a colossal aggregation to be under the management of one head. President Roberts, in his last annual report, says that, with few exceptions, all these corporations are in good financial condition, and are earning fair returns on the capital invested. They represent 7,915 miles of railroad and canal, and have a share and bonded capital of over $700,000,000 They earned in 1890 more than $133,000,000 gross, and moved over 137,000,000 tons of freight and 84,000,000 passengers. In thirty years, on the lines east of Pittsburgh & Erie, the increase in gross earnings was over 800 per cent., and in net was more than 200 per cent. The cost of the securities of other corporations now held by the Pennsylvania was $113,183,734, and the direct revenue from them last year was $4,-439,404, which is in excess of the total funded debt of the Pennsylvania Railroad In connection with the above figures, the report of the London & Northwestern for 1890 is interesting. Its authorized capital is £110,-077,934, or, figuring the pound at $4 85, $533,-877,979. On this the gross receipts from traffic were $29,651,339, and the net amounted to $16,199,117 Dividends at the rate of 4 per cent. were paid on the guaranteed and preference stocks, and of 7⅛ per cent. on the consolidated stock The amount of these stocks is £77,107,238 The mileage of the system was 1,916 4 miles. It will be seen that although the mileage of the Pennsylvania system is 7,915 miles, which is just about 6,000 miles more than the London & Northwestern, the capitalization of the two companies is by no means so far apart, that of the English corporation being $533,-877,979, against $700,000,000 of the Pennsylvania These facts should not be forgotten when the results achieved in both countries are under discussion.—*Railway Age.*

Mr. Robert Quayle, division master mechanic of the Chicago & Northwestern, at Clinton, Iowa, has been appointed master mechanic of the Milwaukee, Lake Shore & Western.

LOCOMOTIVE ENGINEER.
THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed.

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Standing Notices.

☞ *We invite correspondence from Locomotive Engineers and Firemen, Roundhouse and Repair-Shop Employes, and Railway Master Mechanics, on practical subjects connected with Locomotive Operation, Maintenance and Repairs.*

☞ *Manufacturers of proprietary devices and appliances that are novel, and properly come within the scope of this paper, are also invited to correspond with us, with a view to showing their engravings of same in our reading columns. Such illustrations are published without charge and without reference to advertising considerations.*

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A Railroad Abuse that Should be Remedied.

One of the most vexatious problems that manufacturers of railway appliances and supplies have to deal with, and which, in its net results, is not without a bearing upon the welfare of railroad men and the status of important railroad interests, has its root in the action of certain classes of railway officers, and constitutes a flagrant abuse which should be remedied.

We refer to the manner of issuing the numberless advertising pamphlets and dodgers of all sorts that railway passenger and traffic agents or other officials are all the time getting out, in the supposed interest of the road, and for which "advertisements" are solicited from manufacturers of railway appliances who are doing business or hope to do business with the road. Doubtless most of these so-called "advertisements" are solicited with an eye to economy in the cost of advertising the railroad. In many instances there is room for suspicion that the profits derived from their appearance in railroad pamphlets are in the nature of a private "spec.," in which, possibly, the relative or favorite who does the "soliciting" is concerned. In either case, not very much study of the subject is required to show that the railroad pamphlets so issued are by it given such an advertising look and bulk, that the public which might be willing to read them, if issued on their own merits, give them very little attention, and, of course, this tends to defeat the object nominally aimed at.

As a matter of fact, with very few exceptions, the manufacturers of railway appliances and supplies, from whom these so-called "advertisements" are solicited, regard all such solicitation as made under cover of an implied threat of business disadvantage, in case of their refusal to comply. The veiled request is really a demand in the eyes of the manufacturer, with which he complies unwillingly, and is a form of tribute or levy, to which he frequently, in the privacy of his ledger, applies a much stronger epithet.

The reason is plain. A pamphlet is gotten out, containing bird's-eye views, and eulogistic descriptions of the boarding houses, scenery and other attractions along the line of the Bungtown, Bugleford & Bang-up R. R., to be gratuitously distributed among grocers, lawyers, doctors and other non-railroading classes in the community. No matter with what motives advertisements of railway appliances are solicited for such a pamphlet, they cannot possibly do the manufacturer any good, because grocers, lawyers, doctors, etc., do not buy railway supplies themselves, and cannot in the least degree influence their selection, purchase or use.

Now, if this sort of thing involved a tax only occasionally extorted, manufacturers could stand it and still be happy, but the trouble is, that the snap has proven too soft, and the number of railroads practicing or permitting it has come to be legion. Instances are not wanting, in which manufacturers find their bills for this kind of bogus advertising running into thousands of dollars yearly, and some find them so onerous, that they acquire misleading ideas with reference to the whole subject of railroad advertising, perhaps finding themselves able to reserve little or no money to spend for real advertising. Of course this tends to hinder the introduction of new appliances on railroads, no matter how meritorious, and, equally of course, this effect is to the disadvantage of the railroads.

But there is another way in which these bogus advertising schemes operate to the detriment of railroads, and that is by the handicap necessarily put upon the progress of legitimate railroad newspapers, through the diversion of advertising patronage to which their facilities for supplying useful information to railroad men should entitle them. Whatever tends to increase the efficiency of railroad men, benefits the road with which they are connected, whether they are employed in the cab, the roundhouse, the repair shop or the places of higher authority. In like manner, anything which lessens their opportunities for acquiring such increased efficiency, involves injury to the railroads. The tax in question becomes, therefore, a tax on knowledge, detrimental to every legitimate interest connected with railroads. We are glad to say that probably THE LOCOMOTIVE ENGINEER is affected by this cause to a relatively less degree than most railroad papers, because expecting to derive so large a proportion of its total revenue from circulation—the regular edition called for to supply the wants of readers being now 16,000 copies every month—but the fact remains, that the railroads responsible for the perpetration of such an abuse are placing obstacles in the way of their own development and prosperity.

The remedy, if remedy there be, will have to come from one or both of two sources. Manufacturers will have to more generally make up their minds that the implied threat is as devoid of weight as the alleged benefit. A prominent manufacturer has hit upon the plan of requesting the solicitor in such cases to bring him a letter from the general manager of the road, asking him to recognize the publication in question. Forty-nine times out of fifty this letter never comes, and no indication appears anywhere, that his refusal involves any disfavor with the practical or the buying departments of the roads concerned. Another manufacturer asks for a letter from the purchasing agent, and with equally happy results.

The other part of the remedy will have to come from the railroad officials. Passenger and freight agents, and other subordinate officers who have been getting out such publications in good faith, may in time, perhaps, realize that the method they have been following tends to defeat the object aimed at. Those who have practiced it for other reasons, should be promptly set right, by prohibitory orders issued by the general manager.

Old Boilers.

Some years ago, when 50,000 and 60,000-pound cars were first introduced, some enterprising roads painted up some of their old stock, and increased the capacity—with a stencil. Just now there is a fad for high steam pressure, and a master mechanic is almost afraid to have his new boilers built for 140 pounds pressure, for fear of being considered behind the age. There has been no little amount of risk taken in increasing the pressure, on the stencil plan, by screwing down the pop valves. There have already been several disastrous boiler explosions this year, and there will be more. Have you got a boiler in charge that is more than twenty years old, and if your family were going to live over that boiler, and you had your way about it, you would not reduce the pressure by half?

Lithium is the lightest metal in the world, and iridium is the heaviest. The former is worth $6,880 per pound, and the latter $1,070. There are a dozen metals more precious than gold.

Car Coupler Facts.

The action of the officials of the Vanderbilt roads, in deciding to adhere to and hurry the application of the master car builders' standard coupler, known as the Janney hook, will no doubt have a great deal of weight in preventing a reopening of the question by the association. We have little doubt that the coupler has come to stay, and, if it has, the sooner its adoption is universal the better. It is not a perfect thing, however, and has faults that cannot be remedied, if the present lines are adhered to.

To begin with, it is not a mechanical device, no mechanic would think of making a part of a machine to stand buffing and pulling strains in the shape of a bell crank, if he could help it. The "lines" having been established, no improvement can be made, it will be impossible to increase the sizes of parts for any service, the wear of one hundred miles of hard service destroys the contour lines, and a limit for wear of knuckles will soon have to be established that will cost nearly, if not quite as much to keep up as does the present breakage of links and pins. It is altogether likely that, if even the poorest of the link and pin couplers had been adopted universally, a score of years ago, there would not have been the harvest of death that finally made the adoption of one standard kind of coupler imperative. It has been the meeting of different kinds and sizes of couplers that has caused half the deaths of our trainmen, but a very large percentage have lost their lives or limbs simply from the fact that they have been obliged to be on the tops of trains in all kinds of weather, and on all kinds, sizes and shapes of cars.

The universal adoption of the automatic air brake will do far more to protect the lives of trainmen than will the coupler, but both can do much that has been neglected for far too many years

---

On the Connecticut River road they have excellent water, and a leaky boiler is almost unknown. One engine, the "J. Mulligan," named for the president, himself an old engineer, has been in constant service since 1857, thirty-four long years, and has only had one new fire-box; she is a Schenectady eight-wheeler with 16x22 cylinders. There is another engine in the service that has made over 140 miles per day for eighteen years, and the extent of repairs to her boiler has been limited to the removal of a dozen flues to clean out the scale—the original fire-box and flues are still used without a sign of giving out.

Followed Instructions.

Once upon a time there was a road where the officers considered that the conductors were not making a fair divide, and kicked One of them thought he was going to improve matters by eliminating money from the question between the conductors and the treasurer He put up a notice that conductors would not turn in cash, but must buy tickets with money collected and turn the tickets in. One conductor seemed to return about the usual number of tickets as before the change, while the others' returns had increased. After some weeks he was called up.

"We know you have received cash for fares, but your returns do not show it Do you understand the instructions in this matter?"

"Yes, certainly; buy tickets, punch them, and turn 'em in."

"Well, why don't you turn 'em in, then?"

"Haven't got 'em all punched yet."

"What tickets are they?"

"Meal tickets, of course!"

Countersunk rivets are to be avoided where possible. Countersinking weakens the sheet, and countersunk rivets are no stronger than beaded rivets. Countersunk holes should be reamed with a 60° reamer, but the taper should never be deeper than three-quarters of the thickness of the sheet.

One of the greatest blessings secured to the traveling public by the use of vestibuled trains is the drowning of the noise of the moving train To properly appreciate the extent of this, it is only necessary to open the side doors of the vestibules, and listen for a moment to the roar.

ASKED & ANSWERED.

(88) E. A Rox, Zanesville, O., writes.

Suppose a back up eccentric slips, could it be set by putting reverse lever in forward notch, and make a mark on valve stem close up to the gland, then put reverse lever in backward notch, and turn eccentric until mark on valve stem comes to gland, then fasten eccentric; what position would engine have to stand? 2d. Is the go-ahead eccentric always coupled to top of link? *A*—Yes, if you put the engine on either dead center, move the loose eccentric around the axle in the direction it runs when moving the engine 2d Yes; almost universally where the shifting link is used

(89) R. O E., Mt. Savage, Md., asks

Is there a mixture of acids called "bright dip" that will polish rough brass without file or lathe? If there is, please publish the formula *A*—The dip referred to is a solution of potash that cuts off grease, paint and gum from brass immersed in it when hot, and afterward dried in sawdust. It is only used where there is a need of this work in large quantities, such as a general car shop.

(40) J. C., Sherbrooke, Can., asks.

Kindly state reasons in your next issue "why a locomotive with a 17x24" cylinder is superior in starting and handling train to one with 16x20" cylinder" *A*—Because there is more pressure exerted on the larger cylinder, for the same reason that you can lift more with a seventeen foot lever than you can with one only sixteen feet long

Progressive Examination of Locomotive Engineers and Firemen.

By JOHN A HILL

FIRST EXAMINATION.

[*After One Year's Service*]

Q What engine have you been firing?

A. ——.

Q What engineers have you fired for?

A. ——.

Q Has there been anything to hinder or prevent you from picking up desired information for this examination?

A ——

Q Have you been left during the year?

A. ——.

Q. Have you been suspended during that time—if so, what for?

A.——.

Q Have you acquired the habit of comparing your time with the clock or the watches of engineer or conductor daily?

A. ——.

Q. Do you thoroughly understand all the signals in use on the road—yes or no?

A. ——.

Q. What signal devices are provided and in use on your engine?

A. ——.

Q. When used as a fixed signal, and not on a train or engine, what does red signify?

A. *Red signifies *danger*, and is the signal to stop.

Q. Green signal?

A *Caution;* go slow

Q White?

A. *Safety;* go on.

Q What is a green and white combined signal for?

A. To stop trains at flag stations for passengers or freight.

Q Blue?

A To be used by car inspectors. Cars so marked should not be moved.

Q. What is a torpedo used for?

A. Torpedoes are additional signals, and are so placed as to call attention to the regular signals

Q. Then if one is struck you merely watch for the signal?

A No, *One* means stop; *two* is to slow down and go ahead cautiously, looking out for danger signal

Q. What is a *fuzee* used for?

A Danger signal, generally dropped by heavy trains to warn following trains of their presence. They burn ten minutes, and must not be passed while burning.

Q Beside any you have mentioned, what else would you consider a danger signal that would call for a stop?

A Any light swung across the track, or a hat or handkerchief waved, or any violent signal given by any person.

Q. How should the rear of trains be marked?

A Each train, when running, must display two green flags by day and two green lights at night, one on each side of rear of train, as markers to indicate the rear of train. Yard engines will not carry markers.

Q. Then if you were following a train you would be on the lookout for green lights?

A. No, sir. Green lights, as markers, are *toward the front*, so that the engineer can see them, not back, except when the train gets out of the way on a siding, when the green lights must be taken down and red ones put up

Q. What lights must be displayed on the end of trains then?

A. Either a headlight or two or more *red* lights, except yard engines. They must have a headlight on each end, or where but one is used, two green lights must be displayed on the end in place of red.

Q. What is this for?

A To distinguish yard engines from regular road engines.

Q. What is the rule about bell-cords?

A Every car in a passenger train must be in communication with the engine by bell-cord, or its equivalent in the shape of the air signal or electric wire. It must be connected to the bell or whistle of the engine, and through and so connected to the rear car that in event of the train parting it will signal the engineer

Q. What do green flags or lights carried on an engine mean?

A. That the train carrying them is followed by another train running on the same schedule and having the same train rights and no more.

Q Suppose the engine carries white signals?

A Denote that the train is an extra, having no time-card rights. Yard engines never carry white signals.

Q. Suppose you stop at a small place with a single siding. You have a car to set out, and there is one in the siding with a blue flag on it; what do you do?

A Always notify the car inspector or repairer, that he may move his flag to protect himself.

WHISTLE SIGNALS.

Q What does one *long* (——) blast of the whistle denote?

A A station, railroad crossing or junction.

Q. A *short* one (—)?

A Stop; set brakes

Q. How would you ask to have brakes released?

A. By two *long* blasts of the whistle (—— ——).

Q. What do two *short* blasts mean?

A It is the answer to any signal given the engineer, except the one signal "train parted" It means "I understand."

Q. Suppose your train broke in two; how do you notify crew by whistle?

A. By three *long* (—— —— ——) blasts of whistle, repeated until answered.

Q. What do *three* short (— — —) blasts mean?

A. It is the signal for backing, and must be repeated until a signal is received from the rear of the train.

Q What are four *long* (—— —— —— ——) blasts for?

A. To call in a flagman from the west or south.

Q. How would you call in one stationed to the north or east of you?

A. By four *long* and one *short* (—— —— —— —— —) blasts

Q. Why this difference?

A. To avoid making mistakes and withdrawing proper protection from the train

Q. What is the use of four *short* (— — — —) blasts?

A Call for attention to watchmen, bridge or switch-tenders, train crew, or any one.

Q. What do five short (— — — — —) blasts mean?

A. Protect the rear of train by flag.

Q What use is made of one *long* and two *short* (—— — —) blasts?

A It is a call for attention to signals carried by an engine (single track only), and is given to all engines of the same or inferior class trains. It means, "Do you see my signals?"

Q If you were left in charge of the engine on a siding, and a train passed you carrying green flags and gave this signal, what would you do?

A Answer "I understand," by two *short* (— —) blasts.

Q. Well, suppose you were left on a freight engine, and you had green signals up, and a regular passenger train came along, would you call up your signals?

A No.

Q. Why not?

A Because the first-class train would have a superior right to the second section of my train, and would not have to observe signals on freight trains The freights must protect themselves against the passenger.

Q. What is the road-crossing signal?

A. Two *long* followed by two *short* (—— —— — —) blasts.

Q. The cattle signal?

A. A succession of *short* blasts

BELL-CORD SIGNALS.

Q. What does *one* tap of the signal bell mean, suppose you were standing?

*Special rules in use to be added These are the signals provided by the standard code

A. Go ahead, or start.

Q. *Two* taps?

A. If running, stop at once; if standing, call in the flagman.

Q. Three taps?

A. If running, stop at next station; if standing, back up.

Q. Four taps?

A. Reduce speed

Q. If running, and you heard one tap of bell, what would you expect?

A. That the train had parted.

Q. Suppose you found it had, what would you do?

A. Notify the engineer.

Q. What should he do?

A. Give three long blasts of the whistle, and keep the forward part of train going until he was sure that the rear was stopped.

LAMP SIGNALS.

Q. What does a lamp swung across the track mean?

A. Stop.

Q. Raised and lowered vertically?

A. Go ahead.

Q. Swung vertically in a circle across the track when the train is standing?

A. Back up.

Q. Swung the same, at arm's length, when train is in motion?

A. Train parted.

Q. Suppose the same signals were given with a flag or by the hand?

A. They mean the same.

Q. What is a fixed signal?

A. A station board, crossing signal, or any point signal that is not moved.

Q. Suppose you find a signal missing or imperfectly displayed, where one is usually provided, what should be done?

A. The imperfect or absent signal must be regarded as a danger signal and its condition reported.

Q. What use is made of the engine bell?

A. It must always be rung before moving any engine or train, through all tunnels, over crossings, and through streets, and at least a quarter of a mile before and until past all road crossings.

Q. What do you understand by steam pressure as registered by the gauge?

A. Steam pressure of so many pounds per square inch above the atmosphere.

Q. Why do you say above the atmosphere?

A. Because the atmosphere has a pressure, at sea level, of 14.7 pounds per square inch, and the steam gauge registers nothing when there is no steam on it.

Q. In a locomotive boiler is there any part that has more pressure to bear than another?

A. Yes. Steam pressure is elastic, and exerts itself evenly in all directions; but there is more pressure at the bottom, because that part has to support the weight of the water besides the steam pressure.

Q. What object is there in having exhaust steam go through the stack?

A. To increase the draught on the fire.

Q. How does the exhaust steam create a draught on the fire?

A. By creating a current of the gases through the stack, ejecting them and the air in the front end, and forming a partial vacuum in the front and stack.

Q. How does that affect the fire?

A. The pressure of the atmosphere forces air through the grates and the fuel, supplying the flame with needed oxygen, and causing it to burn fiercely.

Q. Then you think a large quantity of air is necessary to make a fierce fire and raise steam rapidly.

A. Yes.

Q. Then why is it that if you have a thin fire, and a hole is made in it, steam will fall at once?

A. The air is cold and goes direct through the flues, cooling them off. In order to have the air do any good it must be thoroughly mixed with the gases given off by the incandescent fuel.

Q. What is black smoke?

A. A mixture of various gases, watery vapor, air and carbon. The carbon is the black part.

Q. Will it burn?

A. Not after it is formed. It can be partly prevented by intelligent firing.

Q. How can it be prevented?

A. The carbon of the coal is released when a fresh fire is put in, and if at the moment of release it can be mixed with the proper quantity of air and kept at high enough temperature, it will ignite and burn. The fuel is cold when first supplied to the fire, and keeps the temperature below the igniting point. The best preventive is to fire "light," that is, supply a small quantity of fuel at a time.

Q. Is black smoke wasteful?

A. Yes, but not as wasteful as generally supposed and claimed. It is very disagreeable to the public, and costs the road a great deal to keep cars and other property clean.

Q. What effect would a very small nozzle have on your fire?

A. It would cause a very fierce draught and tear holes in a thin fire.

Q. What do you have to do then?

A. Carry a heavier fire.

Q. Is there any objection to this?

A. Yes. It is harder to get air through it to keep up combustion.

Q. When the fuel burns most in the front of the fire-box what does it denote?

A. That there is more draught through the lower than through the upper flues.

Q. When it burns most under the door?

A. That there is too much draught through the upper flues.

Q. How can this be remedied?

A. By changing the diaphragm or draught pipe.

Q. What do you do to prevent black smoke from rolling when engine is shut off?

A. Try to put in a slightly heavier fire long enough before shutting off so that the fuel will begin to burn, and not give off black smoke when supply of air is checked. If engine is shut off unexpectedly at any place where it is desired to prevent smoke, opening the fire-door, or slightly starting the blower, will generally prevent it.

Q. What good effect does it have to open the fire-door when the engine is at work?

A. When fire is heavy it sometimes aids combustion by furnishing needed air; generally prevents waste of steam at the safety valve.

Q. What bad effect does it have?

A. Cools the tubes and is liable to cause them to leak.

Q. What are a fireman's first duties on arriving at his engine before leaving time?

A. To see that the engine is ready for the road, that all oil-cans are filled, and all signal lamps ready for use, that the full set of firing tools are in their places, that the flues and ash-pan are clean, and the fire in the proper condition for service.

Q. What effect does wetting the coal have?

A. Serves to keep down the dust and make less dirt, but is a detriment to the fire.

Q. Why?

A. Because all the water taken up by the fuel must be evaporated in the fire before the fuel can be burned.

Q. What should be the condition of your fire on arriving at a station where a stop is made?

A. Avoid putting in a green fire just before a stop.

Q. What should be the condition of your fire when you pitch over the summit of a long grade?

A. The same as for a station stop.

Q. If the engineer keeps using the injector, or pump, after pitching over, how should you maintain your fire?

A. Use the blower and fuel to keep it bright.

Q. Are you making much progress in the study of combustion, and can I explain anything to you, or tell you where to get the desired information?

A. ———.

Q. What do you consider of the first and greatest importance to an engine or train out on the road?

A. Protection, to be certain that the train rules, telegraphic orders, or signals entitled the engine or train to occupy the track where it is, and did or did not authorize it to move to other points; and in case of accident, or the disuse or misuse of the general forms of protection, for the train or engine crew to protect themselves by flags.

Q. Do you assist your engineer when anything is to be done to the engine?

A. ———.

Q. How much coal does your engine generally burn a trip?

A. ———.

Q. Is this more or less than the general average?

A. ———.

Q. How do you account for the difference?

A. ———.

Q. Are you satisfied with the business, and are you fully determined to master it and become an engineer?

A. ———.

LECTURE.

This has been your first year's service, and in consequence the examination has been an easy one. Next year I shall expect that you know all about the signals, and have forgotten no part of this examination. I shall expect you to know the object of every piece in a locomotive boiler, what it is for and how it works. I shall expect you to be pretty well posted on combustion. To this end study your books, and try and get a good general idea of the laws of combustion. I shall not expect you to know all the gases by name, perhaps, but such a knowledge will not hurt you. I shall, however, expect you to be able to tell me what results are obtained by certain combinations of fuel and air in locomotive fire-boxes. I shall expect you to know what effect a fresh supply of coal has on heat-producing flame, where loss occurs and where gain. You will be expected to understand all the draught appliances in use on this road, and tell how to adjust them to overcome certain defects found in the burning of the fire.

You will be expected to know how much coal your engine has burned per mile during the past year (take this from the monthly bulletin, or get it at the fuel agent's office), and how this compares with the consumption of other engines of her class, and give a reason for the difference. You will be expected to explain how steam is generated, tell what constitutes the different kinds of steam, and trace it from the moment it is generated until it passes away from the locomotive and is lost.

I shall expect you to tell the trouble to be expected from low water, heavy firing, holes in the fire, dirty coal, clinkers, etc., and how to avoid this trouble. You will be expected to know what kind of firing has a tendency to cause leaky flues, and what kind prevents leaking.

To know what the brick arch is for, what it does, and under what circumstances it cannot be used.

To know the forms of the different kinds of boilers, and the peculiarities, advantages and disadvantages of each type.

Devote some thought and study during the next year to boilers, their use and abuse, to the combustion of fuel, and the duties of a fireman, for on your proper understanding of this subject your advancement in the service depends.

A New Cab Signal.

One of the engineers on the elevated road in this city had a little breakdown experience recently that he is not liable to repeat.

The bell in the cab gave out, and he tied the bell cord to his leg, so as to be able to properly interpret the signals, and leave his hands free to handle the engine.

It appears that this engineer was accredited among the men as being a crank, and they proceeded to "get even." Three or four of them went back in the train and "doubled up" on the cord, giving a long pull, a strong pull, and a pull altogether, elevating the crank to the roof of the cab twice as a signal to go ahead. The next time the bell gets out of order he will tie the cord to the boiler.

The latest wrinkle in fashionable society is giving "an engine party." A bevy of pretty girls ride in the engine of a special train which is "scheduled for fast time," and carries streamers in distinctive colors.

The Snail-shell Stack.

The engraving shows a rather new form of stack—we have seen worse ones, but not many.

It is not necessary to describe it—one look is enough.

Such a form would doubtless cost four or five times as much as a straight stack containing the same amount of material.

Those of our readers who know how quickly a draught pipe is cut out if it gets, ever so slightly, in the way of the exhaust, can imagine about how far this distillery worm would run before the exhaust would cut a skylight in the highest hump of the crook

The invention comes from Ft. Worth, Tex., and is about the ten thousandth patented smoke-stack, all of which are designed to check, baffle, retard, muffle, puzzle or paralyze the flow of the gases, and collect the dirt in them. The more changing of the currents the more cones, and deflectors, and netting, the sharper the exhaust must be to draw the air through the fire. Sharpening the exhaust means a choked nozzle and increased back pressure. What we want to do is to get more work out of the steam now made. Then we won't have to force the fire so hard to produce it. This will reduce the back pressure, prevent the throwing of sparks, do away with carrying around a ton of extension front, and the care of burned netting, cones and outlandish forms of crumbled-up sheet-iron, by common courtesy designated as a "smoke-stack."

Combustion.

The following paper was recently read in the lodge room of the Brotherhood of Locomotive Firemen, at Albany, N. Y., by a young fireman from the Boston & Albany road. As will be seen, it was written for lodge room purposes rather than for publication. Our attention was called to it by an officer of the road employing the young man, who spoke in the highest terms of praise of the effort for self-improvement. No individual or association of individuals can estimate the value they store up in themselves by taking part in this kind of work; it pays in the long run.

This fireman signs himself "W. A. B."—like all the other B. & A. men, being only modest about using his name.

The question is asked, What is combustion?

The answer given in the least number of words would be as follows:

Combustion is a rapid chemical combination of oxygen with the substances which constitute fuel.

This subject covers a great deal of ground; for when any substance has become ignited combustion has begun. Now the part which I have taken, and that which directly interests us as locomotive firemen, is combustion in locomotive fire-boxes. In order to form combustion there must be oxygen and a substance with which it may unite.

Oxygen is one of the gases of which the atmosphere is composed; the other, nitrogen—which is in the locomotive fire-box when the atmosphere or air enters it; the oxygen is separated from the nitrogen and unites with the fuel, the nitrogen passing through the flues and out the stack.

The fuel used on nearly all the principal railroads in this country is bituminous coal, but on some roads anthracite coal is used.

Bituminous coal is composed of from 50 to 80 per cent. carbon, 6 to 10 per cent. hydrogen, the remainder being sulphur, sand, iron and other substances, part of which are not consumed and go to produce ashes and clinkers, which, as we all know from experience, is one of the fireman's chief discomforts.

Anthracite coal is composed of from 70 to 90 per cent carbon, the remainder being hydrogen and foreign substances, such as are found in bituminous coal.

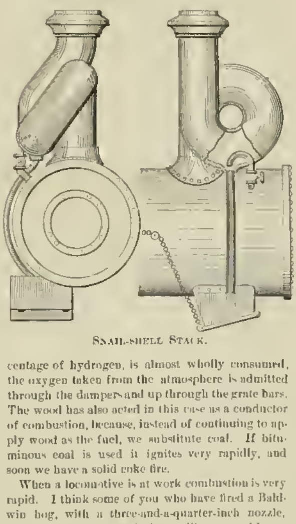
Now, we will say, here is a railroad with all the equipments, rails all laid, cars ready for transportation, locomotive standing in the roundhouse, and everything that is necessary to operate a railroad. But the locomotive stands here without a fire, consequently she has no steam, and without it she is useless. But here is the fireman, the fellow that always has a dirty face and dirty hands, and the one that will, if he sees what he thinks is a girl within half a mile, drop his shovel, get up on the seat-box, and put on one of his Sunday smiles, and if the young lady happens to look up and sees him, she says to herself, "I wonder if that fellow knows the use of soap and water."

This very important youth gets the locomotive ready for service, which by so doing the railroad is put in operation.

We will now follow the fireman as he steps on his engine, supposing the engine to be dead, that is, "without a fire," and with two gauges of water in the boiler. He first puts some oily waste on the grate bars, then he throws in wood enough to fill the fire-box about half full and shuts the door. He then goes down in the pit, and with a match, or generally a torch, he starts the waste, and in a very few minutes the wood has become ignited. He then puts in four or five shovelfuls of coal on top of the burning wood, and from time to time keeps adding more.

Soon the wood has all disappeared, and we have a coke fire, and the engine is ready to couple on the train, as far as the fire is concerned. Here we have combustion. First the waste, next the wood, and then the coal being ignited. In the first case, the waste, being saturated with oil, is very rapidly consumed. Now this oily waste has acted as a conductor of combustion, because combustion really began when the match was lighted.

The wood has become ignited, and we have combustion in the case of the wood. The wood being composed of nearly solid carbon, with a small per-



SNAIL-SHELL STACK.

centage of hydrogen, is almost wholly consumed, the oxygen taken from the atmosphere is admitted through the dampers and up through the grate bars. The wood has also acted in this case as a conductor of combustion, because, instead of continuing to apply wood as the fuel, we substitute coal. If bituminous coal is used it ignites very rapidly, and soon we have a solid coke fire.

When a locomotive is at work combustion is very rapid. I think some of you who have fired a Baldwin hog, with a three-and-a-quarter-inch nozzle, cutting off on 15 or 18 inches, will agree with me here.

In order that an engine may steam well, it is essential that the following be observed First, that the area of heating surface be in comparison with the size of boiler, and the boiler should be so constructed as to be capable of generating steam rapidly enough to supply the cylinders in doing the work laid out for the engine. As we have to employ artificial draught, it is essential that we have the grate surface as large as possible in order to make the blast orifice, or nozzle, as we call it, large enough, so that it will not create too much compression in the cylinders. Second, I will ask the question, How is artificial draught produced in the locomotive?

It is produced by a partial vacuum formed in the arch or front end.

The front end must be tight, so that the air will have no access to it except through the flues.

The exhaust from the cylinders being contracted by the nozzle is used as the means of forming the vacuum.

Third. All soft coal burners—I say soft coal burners, as I have never had any practical experience with an anthracite coal burner—should be equipped with an ash-pan with a front and back damper, capable of being closed, so that they will be perfectly tight.

Fourth. There should be some means of admitting air on top of the fire. Some of our engines have a double row of hollow stay bolts along the sides of fire-box, which I think a very good idea. Others have several holes in the furnace door, and all locomotives have a latch by which the door can be made to partly close at the will of the fireman.

We will now follow the process of combustion, taking it up as the engine starts with her train, supposing the engine to be of the standard American type, a four-wheel connected freight locomotive.

The dimensions of furnace being as follows: 6 feet long, 3 feet wide, and about 2 feet deep beneath the flues.

As I have before stated, we have a solid coke fire, probably about 1 foot thick, and all it needs is to be loosened, which is done with a bar about 8 feet long. The back damper is open, and, as the engine starts, the artificial draught produced by the exhaust steam from the cylinders begins to form a vacuum in the front end or arch.

As the exhaust leaves the top of stack it has taken the air with it, and immediately the hot gases rush through the flues to fill up the space. The next exhaust takes with it the gases now in the arch, and at the same time it forms another vacuum, and so on it continues as long as the engine is at work.

When the blower is used it acts upon the same principle What is it that forces the gases through the flues and into the arch? It is the pressure of the atmosphere underneath the grate bars continually forcing its way up through the fire, at the same time the oxygen is separated from the nitrogen, the oxygen uniting with the hydrogen and carbon of the fuel forming the hot gases, and with the nitrogen which is not used pass through the flues and out of the stack. There are a great many men, I am sorry to say, that are laboring under the impression that the exhaust draws the gases through the flues. This not being the case, as I have before stated, it is the pressure of the atmosphere underneath the grate bars, which, on a well-designed locomotive, would be several tons, provided a perfect or nearly perfect vacuum could be produced in the front end, but a difference of pressure of the air in the smoke-box and at the grates of one pound per square inch would be extra good practice. Let me illustrate this. Now, when the engine is hard at work, if you open the furnace door, and leave it open for a few minutes, the atmosphere, instead of forcing its way up through the fire, enters at the door, a much easier way, and passes over the top of the fire so rapidly that it does not have time to unite with the fuel, goes through the flues, and so on out the stack

If you observe its color as it leaves the stack, you will see that it is as clean as when it entered the door. If you look at the gauge, you will see that the pressure has fallen five or ten pounds. Why this change? Because instead of the oxygen of the atmosphere uniting with the fuel and forming the hot gases (which would be, when they leave the stack, of a dull brown color), the atmosphere passes through the flues in its natural state.

We will now return to the condition of our fire when we left it

The atmosphere enters the ash-pan through the back damper and passes up through the grate bars

The oxygen of the atmosphere unites with the hydrogen of the fuel and forms the gases or flame which is the hottest; but through bad firing and the ill construction of some locomotives this is nearly all lost, passing through the flues and out the stack in the shape of black smoke.

Combustion in the locomotive fire-box is carried on so rapidly that it is impossible to consume all the gases. But by the aid of good judgment on the part of the fireman, and some means of admitting the required amount of air on top of the fire, taking care not to get too much, a great deal that is lost in the shape of black smoke can be burned, which, of course, is a saving on fuel.

Again, as the atmosphere forces its way up through the fire, the oxygen unites with the carbon of the fuel and forms coke. This is entirely consumed in the furnace, except that which is carried out the stack in the shape of sparks, providing the fireman understands his business.

After the engine has run we will say about thirty miles, the engine being worked to her full capacity, as they usually are on a freight train—of course we will take into consideration the quality of the coal used—we will begin to experience some trouble with the ashes and clinkers that are beginning to accumulate on the grate bars.

Now where do these ashes and clinkers come from, if the hydrogen and carbon are either consumed or expelled from the furnace?

In all coal, as I have before stated, there is a certain amount of foreign matter, such as sulphur, sand, iron, etc., which are not all consumed during the process of combustion, and these remaining substances go to produce the ashes and clinkers. The grate should be so constructed that by turning them over once or twice, or shaking them when arranged to shake, the dirt can be dropped in the ash-pan.

Now the ash-pan being partly full of ashes, there is not a sufficient amount of air admitted through the back damper, and by opening the forward damper the required amount is obtained, and you go on as before, until the fire requires cleaning a second time. You then proceed as before, and, when you have done so, the ash-pan will probably have to be cleaned out to admit the required amount of air and also to insure the safety of the grates. If you then have a clean fire the front damper may again be closed, and your fire is in as good shape as when you started on the trip.

I have heard a great many firemen say, this engine should be fired with a heavy fire, and that engine should be fired with a light fire.

Now such talk don't amount to a row of pins.

I say that no soft coal burner should ever carry more than from twelve to fifteen inches of fire, and I prefer to fire generally with from eight to ten inches. Understand this must be all fire, and not a pile of green coal and clinkers.

Another thing that is very important in an engine's making steam, and that is, not to allow the flues to become stopped up.

Nearly all of our Baldwin hogs have a brick arch in the front end of fire box.

Now the theory of the brick arch is all very well, and it is a coal-saving device, providing the brick is in the proper shape.

What I mean is, that it shall be put in in the proper manner, be all there, and the flues all clean behind it.

But when engines are run as those engines are, it is more of a nuisance than anything else. The engine does very well for maybe two weeks after the arch has been put in, then the flues begin to get stopped up, and maybe the front brick falls down, and woe be unto the poor unfortunate that has to pull it out.

He gets the hook red hot, bends it in the shape of a grape vine, burns his hands, says bad words, and just as he has got about half of it out he breaks the end off the hook; then he is in a fix. But finally he puts all his wits together and comes to the conclusion that he will bend it over to within about six or eight inches from the end, and he calls the engineer to help him and between the two, and an unlimited amount of bad language, the job is finally completed.

But then there is about half the pieces of the brick yet to be gotten out, and the poor stoker, with the help of the engineer and head brakeman, manage after awhile to either get them out or pull them back so as to make room for a little fire in front, and little it is, for when you get started it would take a steam shovel to keep anything like a fire up in front.

Then the flues begin to stop up very rapidly and no way to clean them out, for if you attempt to punch them out from the front end, you have first got to take the diaphragm rigging out, which takes about half a day, then you cannot get behind the steam and exhaust pipes, and, after you are all through, you want a watchmaker to put it together again.

There is yet another thing which I must mention, and that is, the front ends or arches.

On nearly all modern locomotives, especially those built within the last three years, will be found the extension arch. But we will first take up the old-style arch with the diamond stack and petticoat pipe. In the first place, the arch must be perfectly tight, so that air cannot reach it except through the flues. Next, there should be a netting and cone in top of stack, taking care that the netting shall not be too coarse, for, if this precaution is not observed, the engineer is apt to receive a letter from the super. asking if he celebrated the Declaration of Independence all the year round.

The nozzle or exhaust tip should not be either too large or too small, for one produces as bad an effect as the other.

If the nozzle is too large, the blast will not have sufficient force to form a proper amount of vacuum in the arch, and if too small, the vacuum will be formed so rapidly that the fuel is forced through the flues and out the stack before it has had time to become ignited.

The last, but not the least important, is the petticoat pipe. There can be no rule given for the dimensions and adjustment of this indispensable article. It should be made so that it will reach within about eight or ten inches of the base of stack, and be fitted with a movable sleeve at the top and a flare at the bottom, and, when placed in position, the center of pipe should be directly under the center of stack.

Experience will determine the distance it should be placed from the bottom of arch and the space intervening between it and the base of stack.

If set too low at the bottom, the lower flues will become stopped up very easily, and if set too high, the draught through the lower flues, which will act on the forward part of the fire, will be too strong. If the top of sleeve be too high, or too near the base of stack, the upper flues will likewise stop up easily, and if too low, the draught through the upper flues, which will act on the back part of fire, will be too strong. It should be adjusted so that the draught will be equal in all parts of the fire-box.

It will be found, with careful firing, the flues will keep themselves clean, and the engine will make plenty of steam with eight or ten inches of fire.

The extended front end, which is now being put on nearly all new engines, is a little different in its construction, the exhaust pipes extending to within twelve or fifteen inches of the top of arch, the tips being placed above a wire netting which extends all across the top of arch.

Back of the exhaust pipes is a deflector or diaphragm plate, which, raising or lowering, regulates the draught, performing the same duties as the petticoat pipe in the old-style arch.

There is a slight difference in the construction of the arches in different makes of engines.

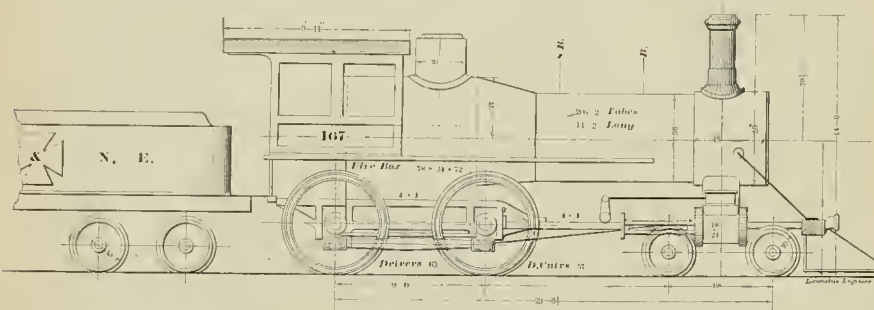
The New England "White Wings" Train.

By L. R. Pomeroy.

Through the courtesy of Mr. Albert Griggs, supt. motive power, the writer was afforded an opportunity of a ride on the locomotive which draws this peerless train.

CONDITIONS.

85.8 miles without a stop; schedule time, 135 minutes; a line with scarcely two consecutive miles of straight track; a succession of heavy grades for seventy-five miles, some of which are long and trying, for example, one grade of 14 miles 40 to 60 feet to the mile, and another of 22 miles varying in amount. Train composed of seven heavy cars, as follows:



THE "WHITE WINGS" TRAIN LOCOMOTIVE.

6 cars at 35 tons each	210 tons
1 diner	41 "
Engine	54 "
Total weight	305 "

Track in excellent condition, displaying great care and watchfulness on the part of the "Department of Maintenance of Way." All dark places well protected by efficient signaling.

HOW THESE CONDITIONS WERE FULFILLED.

The locomotive was designed by the supt. motive power, Mr. Albert Griggs, especially for these conditions, and the advantage in having the drivers 63 inches is apparent, when the physical conditions of the line are taken into account; and the great teacher, experience, has borne testimony to the wisdom of this design, making possible a more uniform speed for the entire distance.

The following outline will show the general features of the engine:

Total weight, 109,000 pounds, on drivers, 62,000 pounds, boiler material, ½" Carnegie's steel; steam pressure, 160 pounds per square inch. Heating surface, fire-box, 138 square feet; tubes, 1,205 square feet, total, 1,343 square feet, wrist-pins, 8½ x 3½"; crank-pins, 3¾"x4"; valve travel, 5½"; bridges, 1¾" thick, exhaust port, 2¾"x17"; lap O. S. ⅞"; lead, 1/16"; eccentric throw, 5"; valves, line and line inside, single nozzle, 4¾" opening, radius of link, 57"; distance between eccentric rod pins, 11"; offset of link saddle pin, ¼; eccentric rod pins, 1¾" back of center of link; lower rocker arm, 9½", upper, 10¼"; center of lifting shaft, 18" back of center of rock shaft; center of rock shaft, $6\frac{3}{4}''$ above top of frame; center of rocker, 3" above top of frame, length of lifting arm, 18; link hanger, 15"; points of cut-off according to notches in sector (forward gear).

1st	notch,	$4\frac{1}{8}''$.
2d	"	$8\frac{13}{16}''$.
3d	"	$13\frac{1}{4}''$.
4th	"	$16\frac{1}{4}''$.
5th	"	18
6th	"	$19\frac{1}{4}$
7th	"	$20\frac{1}{4}$.
8th	"	$21\frac{1}{4}$

The train and service leave nothing to be desired, and is beginning to be appreciated by the traveling public The number of passengers increased 17 per cent. the first ten days

THE RUN.

The train pulled out exactly on the minute, *i. e.*, 3 P. M., and No. 167 lifted the train into speed without a slip or groan, first crossing drawbridge, then running a sharp curve at South Boston. The first mile (through the crowded yard) consumed three minutes, the next 2.7 miles consumed nine minutes; the next 13 3 miles consumed sixteen minutes (49.8 miles per hour), at which point the train was up to schedule. The fortieth mile-post was passed in just one hour from the start, and the balance of the distance, 45.8 miles, consumed 75 minutes to stop, being the end of the run. Three reductions of speed were made—one slow up for a crossing, one for water (by scoop), and one for a junction.

Going west, the running time is made with comparative ease, but going east the New Haven road very frequently delivers the train to the New England considerably behind time, necessitating sharp work on the part of No. 167, and some notable runs on this account have been recorded; one in particular, the writer recalls, of 48 miles in 51 minutes, on an average of 56.47 miles per hour.

It is readily seen that it is necessary to design an engine for this service with ample reserve power, and No. 167 fulfills these conditions admirably.

At Willimantic the train is turned over to the New Haven road, and from this point to New York the run was comparatively uneventful.

A person making this run from Boston to Willimantic cannot help being impressed with the great uniformity of speed and steadiness of the run, and with all the absolute absence of black smoke, and these respective conditions are fully accounted for

First—The comparative small wheel admits of the engine gaining and maintaining such a speed on the ascending grades that it is not necessary to make spurts on the descending grades, and on tangents, as heretofore with engines in this service with larger wheels.

Second—No more competent engineer can be found than Mr. E. E. Potter, who guides this train, and the writer was greatly impressed by the skill and watchful care displayed, together with the keen eye after the economics manifested.

Third—The careful and intelligent firing of Mr. C. E Robins contributed in a large degree towards the results accomplished

The best work was done with the lever in the second notch cutting off at $8\frac{13}{16}''$; when hooked back to the first notch, cutting off at $4\frac{1}{8}''$ the engine labored and seriously objected, and at no time was the throttle stem out more than three quarters of an inch, showing the wide margin of reserve power.

The Best Form of Boiler.

Mr. John Hickey, Superintendent M P. of the N. P. Railroad, recently spoke on locomotive boiler construction before the Western Railroad Club Mr. Hickey favors the form of boiler now widely known as the Sample boiler, having a wagon top extending ahead of the fire-box in order to carry the dome and admit of the use of radial stays

The speaker favored a brick arch supported on tubes running lengthwise of the boiler, heads braced by straight rods fore and aft, rather than diagonal braces from the shell to the heads, a double-riveted mud ring and an arched crown made in one piece with the side sheets, the outside shell sheet being also in one piece; tubes arranged in vertical rows and cross-pieces of plate above the crown, to prevent surging of the water

Among other sensible things Mr Hickey has this to say on the subject of domes:

It is the opinion of many that the dome is a means of supplying dry steam to the cylinders. Now, while this may be a fact when the domes are located only a short distance from the heating surface, it is not true when the domes, as in the case of many boilers, are located some distance therefrom. The fact is that a high dome, situated some distance from the heating plates, instead of furnishing dry steam to the cylinders, as is usually expected, delivers steam of a moist character, particularly so, if it is not perfectly and fully covered with non-conducting material to protect it from the surrounding atmosphere. Sufficient steam room between the surface of the water and the shell is a far more desirable place in which to store steam. Domes, of course, afford a convenient means for throttle valves and other attachments, but they should be no higher than is absolutely required

On the care of the boiler after it is put in service he says:

The care and management of a boiler is of as fully great importance as to have it properly designed and constructed. It is at best subject to destroying forces which may reduce its factor of safety from the first day. The principal causes leading to this end are sudden and unequal expansion and contraction of the boiler, as a whole or in part. This evil is created in its worst degree by washing out with cold water while the fire-box or other parts of the boiler are at a high temperature, thus contracting the lower sheets, while those on top are in a high state of expansion, thereby placing the boiler to a stress greater, perhaps, than any ordinary working pressure it may be called upon to bear Impeded circulation of water within the boiler, caused by accumulated incrustation, or restricted waterways, when these conditions exist in connection with the surfaces exposed to the fire, are influences which rapidly lead to fatigue of the metal. Permitting the entrance of cold air to a fire box, immediately following the dumping of fire from the grate bars, and the extravagant use of the blower when trying to raise steam hurriedly in a fresh-fired boiler, thus heating and expanding the tubes, result in distortion of tubes and tube sheet, brought about by the hasty heating of these parts, while the shell of the boiler is comparatively cool. Low water, when sufficiently low to permit overheating of the plates, results in permanent reduction of their strength

Economy in Use of 60,000-pound Cars.

At a recent meeting of the Central Railroad Club at Buffalo the above subject was discussed after hearing a report of the club's committee on the subject.

The report of the committee on "Whether results have shown economy in the use of freight cars of 60,000 pounds capacity for merchandise," consisting of E D Bronner, A. C. Robson and A. Vail, was presented by Mr. Bronner. It stated that ten replies were received in response to letters of inquiry sent out Five roads stated that they had used cars of this class extensively, that the carrying capacity is utilized to its utmost limit, that the cost of maintenance is no greater than that of smaller cars, and conclusions based upon practical experience were that they are economical, both from mechanical and operating standpoints The other five roads owned no cars of the capacity named, and of these, two did not favor them From statistics furnished by large manufacturing car builders, the following average prices and weights for 20 and 30-ton cars were derived

	Total Capacity	Total Weight	Total Cost
3 20 ton cars .	120,000	72,000	$1,575
2 30 ton cars	120,000	60 000	1,300

The comparison shows a saving in dead weight on every 60 tons carrying capacity of 12,000 pounds as well as $275 in the cost of the cars. In the opinion of the committee the expense in repairs would show a decrease in favor of the 30 ton car; *i e.*, the three cars required to carry 60 tons will cost more to maintain than the two cars of larger capacity It might be argued that the larger weights will be more destructive in their effect on the 30-ton cars, but this is not the experience of the roads that have adopted them, as in a well-designed wooden car the parts are increased in proportion to the increased strains. The committee was of the opinion that all the arguments brought to bear in favor of the 20 over the 10 ton car will apply in this case, provided it is admitted that the 20 ton car is not the maximum practical limit, and the report closed with an affirmative answer to the question with which it dealt.

Pedrick & Ayer, of Philadelphia, have issued a large and very handsome catalogue of all the tools they build It not only shows the tools themselves, but illustrates many attachments, and shows many applications of these tools to different kinds of work. As usual with this firm, the book is a work of art. Harry Ayer's fine Bohemian hand is visible from A to Izzard.

Train wrecking costs the wrecker his neck in California now—if he is found out.

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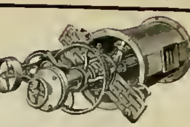

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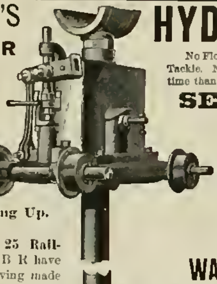

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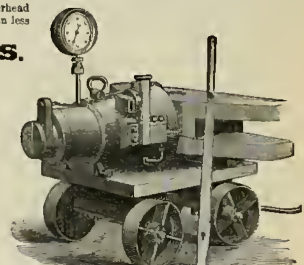
Hydraulic Press for forcing pins into Locomotive Drivers, either under the engine or out. Also useful about Railroad Shops, for forcing on and off Balance Wheels, Cranks, Gears, Pulleys, etc. Inclosed Piston. Cannot Clog. Valves are large and fall to their seats, no rush of water being required to seat them. Parts easily examined or repaired. Pump is independent of cylinder casting. Movement of ram, 12 inches. 60 to 150 tons pressure.



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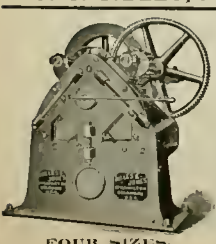

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THE GENUINE LORD'S BOILER COMPOUND,

Which is acknowledged by authorities and accorded the confidence of the manufacturers throughout the United States and foreign countries, is manufactured exclusively by G. W. Lord, practical chemist and inventor. Attention is called to other parties, who, through the appropriation of G. W. Lord's antiquated patent, have deluded many manufacturers into presenting them with their order for Lord's Boiler Compound. The use of the above formula, patented in 1869 by Mr. G. W. Lord, has been long discontinued by him, owing to his discovery of many new chemicals, which upon critical experiment have demonstrated their superiority. Lord's Boiler Compound, manufactured at the present time, is an article greatly superior to the formula patented by Mr G. W. Lord. For decree of court, etc., address G. W. LORD, 320 Union Street, Philadelphia, Pa.

The Locomotive Engineer.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 7. NEW YORK, JULY, 1891. $1.00 per Year or 10c. a copy.

Taking Desperate Chances.

On one of the fastest runs the country has heard of in some time, there was a little side incident that, had it been known back in the coaches, would have caused a stampede for the bell rope.

Shortly after starting, the engineer discovered that the bolt that holds the inside pair of guides to the cylinder head was loose, he watched anxiously, knowing that a stop and a disconnect meant a bad reputation for him as a flyer, he came to the conclusion that the outside pair of guides would hold the crosshead, and that the bolt was simply jarring loose It grew steadily worse, and finally dropped out, the top guide swung in toward the frame, but the engineer kept up his speed, and kept his eye on the guide. The gibs flew off the crosshead, and the guides soon left the yoke to help ballast the track and the engine ran in this condition in the neighborhood of one hundred miles, reaching a speed far in excess of 60 miles per hour.

The engineer was not censured by the officers—because he was successful. Suppose the other guide had let go? There might have been a —— "

W H. Hudson has been appointed M M of the E. T, V & G at Atlanta

A Mechanical Feed-water Purifier for Locomotives.

The device here shown is an attempt to take from the water used in locomotive boilers some of the impurities by mechanical means. The designers do not claim to handle all kinds of bad water, or to get all the impurities out of any water, but have proven in practice that they can take out enough mud and lime to double the life of flues and extend the period between washing out four or five times as long as for plain boilers.

There have been so many cure-alls offered for bad water that railroad men as a rule are prone to avoid the subject—it has been worn out

This purifier works on a different principle from any we have seen, and has some advantages over any of the others

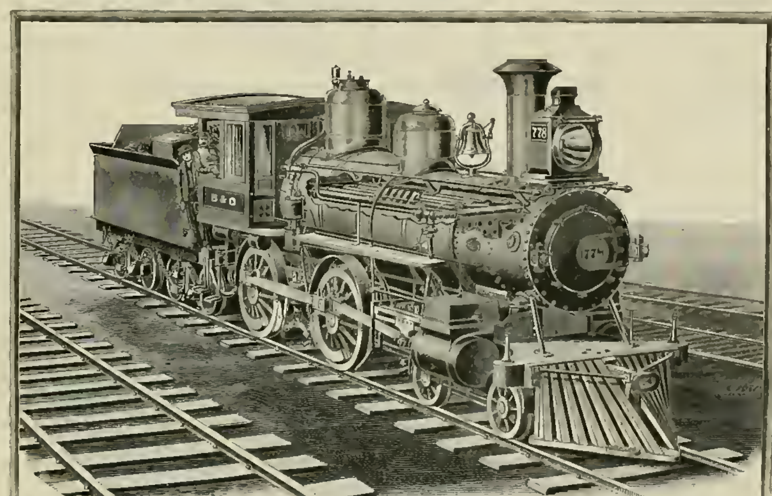
The principal objection to feed-water purifiers, located inside the boiler, has been that they were so made as to require the removal of the boiler-head to get them in, they were located in the steam space, and scale baked upon them, soon filling them up, their frequent blowing off lost a great deal of water, and anything that prevented the prompt closing of the blow-off cock would allow the water to be blown down to a dangerous point

This device can be put into the boiler in sections through the dry pipe hole in front tube sheet; it is located below the water line, and scale-forming matter is deposited on the interior surfaces in a moist form, and not baked on, the flow of feed-water being very sluggish and the delivery being above the water line, in blowing off, only the water in the purifier is lost, dry steam forces the mud and scale out, and it is impossible to endanger the crown sheet if the blow-off cock sticks open

The engraving on this page was made from a photograph of a B. & O engine now running with the purifier, and shows how it is hung in the boiler, it is only necessary to make two holes in the shell just above the flues near the forward tube sheet, and these holes are protected by brass flanges to which the cross-piece is fastened. Both injectors are connected to this cross-piece, as is also the blow-out plug

The engravings on page 122 show the plan of the tubes as well as the details of the interior sheet metal surfaces, for deposits, and the series of dams to retain the mud.

The purifier is made of 4 or 5 inch pipe, according to size of boiler, and is six times as long as the tubes, this large area of pipe causes a sluggish flow of water, which becomes heated above the boiling point by the time it reaches the middle of the purifier, and is then increased to about 300°



FIELD FEED-WATER PURIFIER

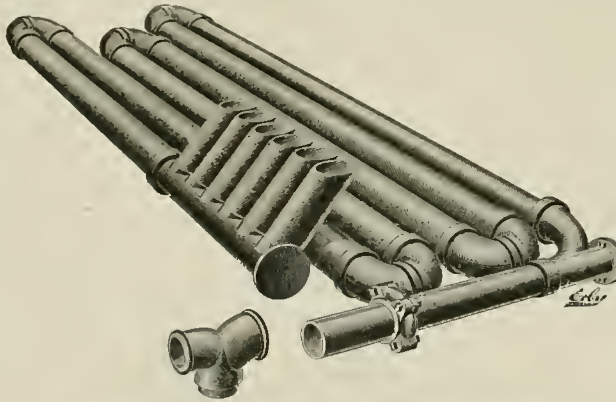
before reaching the large outlets into the steam space of the boiler. Heat precipitates impurities depositing the scale-forming matter upon the interior surfaces of the device or sending it to the bottom in the shape of mud; here it is retarded and kept back by dams, where it can be blown back through the large blow-off cock provided.

The interior tubes are made of sheet steel easily removed, if necessary, when heater is out.

The writer recently inspected one of these heaters that had been in use for some fifteen months in an engine of the Wisconsin Central, then in the Waukesha shop for general repairs. They have bad water there, and experience much trouble from mud and scale, but this device was found to be in good condition, not filled up, and the engine had only been washed out twice in five months, instead of every two weeks, as is the rule.

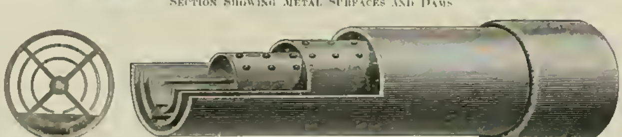
The B. & O. engine shown herewith has also done remarkable work with the purifier; it is also in use on the Great Northern & Southern Pacific.

This device seems to be constructed on common sense lines, to work in practice, to cost little, require no repairs, and be of little trouble to the engine men, and is worth investigation by any master mechanic who has the care of boilers using bad water. It is made by the Field Feed-water Purifier Company, of Chicago.



PURIFIER AS IT GOES IN BOILER.

SECTION SHOWING METAL SURFACES AND DAMS.



DETAIL OF SURFACES FOR DEPOSITS.

A Useful Memento.

The annual convention of the American Society of Civil Engineers was held on Lookout Mountain, Tenn., on May 20th.

The Queen & Crescent gave them a special from Cincinnati to Chattanooga, and the engineering department of the road got out the neatest and most interesting pamphlet, describing the points of interest along the line, that we have ever seen.

There is a margin index that gives the miles, geological formation, and altitude; then the points of interest are named and briefly explained just as a person who knew the country would, if seated by you in the cars.

History of places is outlined, battle fields pointed out, principal industries mentioned, natural formation of the country explained, sizes, cost and length of principal bridges and tunnels given, and, in fact, all the prominent or interesting things along the line are mentioned in an entertaining way. If the passenger departments of our railroads would get out little books on this line, entertainingly written, they would be more than appreciated by the traveling public, and would be kept by many, to aid the memory in recalling journeys for business or pleasure.

Some petty division superintendent on the Chicago & Eastern Illinois has issued an order that train and enginemen must not stop to eat at the only place on a division of over a hundred miles. The men are often obliged to double, and are as often delayed three or four hours on the run—this obliges them to eat from three to five meals out of a lunch pail, with no chance for a warm bite, or go hungry. For our part we don't see why this little two-for-a-cent straw-boss don't make them leave their dinner pails at home—or charge them for carrying them. Railroad men who want to eat every day are "trying to run the business of the company," and ought to be shot down—send for Pinkerton's. They will want to sleep next.

"A Man's a Man for a' That."

We have before us a photograph of about as handsome a testimonial as we have ever looked at. It was presented by the employes of the motive power department to W. T. Small, late Superintendent of M. P., Northern Pacific Railway, on his leaving the service. The scroll is signed by every master mechanic on the whole system, and ought to be, as it no doubt is, highly prized by its owner, coming, as it does, not only from the hands, but the hearts of the men who have been long associated with Mr. Small in his work. It reads as follows:

W. T. SMALL, *Supt. Motive Power, Machinery and Rolling Stock, Northern Pacific Railroad—Machinery Department Employes:*

DEAR SIR—We learn with profound regret that you are about to sever your connection with the great corporation you have so long, faithfully and efficiently served. This regret is shared by all who have worked under your directions, and as you are about to leave us, it is fitting that we give expression to our esteem and affection for one who has been not only our superior officer, but our friend and ready helper.

The manifold duties and great care which devolve upon the occupants of high official positions, are such as to almost inevitably separate them, so far as personal regard and sympathy are concerned, from their subordinates. Very often to the organizer and superintendents of large and important enterprises, the men who are necessary to carry out the details, lose their individuality, and are looked upon simply as parts of the great machine. In the discharge of the great duties and responsibilities that have devolved upon you, however, you have never lost sight of the individuality of your subordinates. In all your business relations with us you have treated us kindly and considerately. You have sympathized with us, appreciated our work, and whatever our station has been, your actions have shown that you fully endorse the sentiment of the poet Burns—

"Rank is but the guinea's stamp,
A man's a man for a' that."

To a skill and knowledge which have rendered you familiar with the smallest details of your great department, you have added an executive ability of the most remarkable scope and power. Skilled in your profession, we esteem you as a master among mechanics. Able in your administration, we confide in you as an executor. Blameless in your life, we honor you as a citizen, just and true in your rulings, we admire you as a man, thoughtful and considerate in your bearing, and in all your relations to those under your directions, we love you as a friend.

In whatever field of activity the future may find you, we feel assured it will add fresh laurels to your name, and enhance an already brilliant record. However great the distance between us, our heartfelt wishes for unqualified success will always attend your life's journey. We realize that the universal satisfaction felt under your administration here will follow you in your future field of duty, and the benefits we have received and learned to appreciate from your influence will be enjoyed by those under your supervision. While bidding you a sorrowful farewell, we bid you a hearty God-speed.

Signed on behalf of the employes

A. BARDSLEY,
M. & St. P. Divisions.
R. H. GILMOUR,
Manitoba Division.
S. L. BEAN,
Dakota Division.
F. D. MACFARLAND,
Missouri Division.
G. W. GARDNER,
Yellowstone Div.
B. HASKELL,
Rocky Mountain Div.
ANGUS BROWN,
Montana Division.
H. H. WARNER,
Pacific and Cascade Division.
WILLIAM MOIR, Idaho Division.
R. M. DE LAMBERT, General Secretary.
St. Paul, Minn., March 31, 1891.

They also presented Mr. Small with a purse of $2,000. We do not approve of these big presents from men drawing small pay to one drawing a larger check, but the boys wanted Mr. Small to know how they appreciated him. The testimonial is enough, and the best of the two.

In putting hose fitting into air hose some shops use soft soap, some oil, and some white lead; but the D. & R. G. have found that sperm gives good results, does not rot the hose, or cause the rubber to stick to old fittings, causing trouble to get them out of ruptured hose. The sperm is kept melted, and the fitting dipped into it for about half an inch. This becomes thick before the fitting enters the hose, but stays and lubricates all the way. It fills up rough spots, and prevents tearing the lining of the hose.

Machine for Attaching Air-hose Fittings.

The machine illustrated herewith was designed and built at the Oakland, Cal., shops of the Southern Pacific, and is the best and most complete of anything of the kind that we have seen.

As will be seen, the fittings are forced into the hose by air operating the piston of a common freight-brake cylinder.

to cross-piece, bolts passing through guide bars and tapped into top plate (2). Block *C*, 3" thick, fitted with sliding plate (3), which projects 4" beyond inner edge, and is bolted through block with C. S. hd bolts tapped into top plate (4). These blocks are grooved, as shown, 1½" diameter, the inner edge 2" diameter and 2¼ deep for expansion of hose, the inner edge covered with ¼" iron plate (5).

The guide bars (6), ¾ x1½ x23", let down flush and projecting up to bottom of grooves in blocks. Stop plate (8), ¾ x8 4¾", let down flush in side frame between the guide bars. Oil-pan (9), 4 x6" x 15, as shown. Cylinder *D*, ordinary freight-car cylinder-bolted, as shown, placed 15¾" from inner edge of blocks to cylinder head, center line 1⅝" above frame. Cylinder *L* 4" diameter fitted through leg and bolted as shown. For cylinder release *k* and *n* use "Bassett's" air-brake valve; the cocks

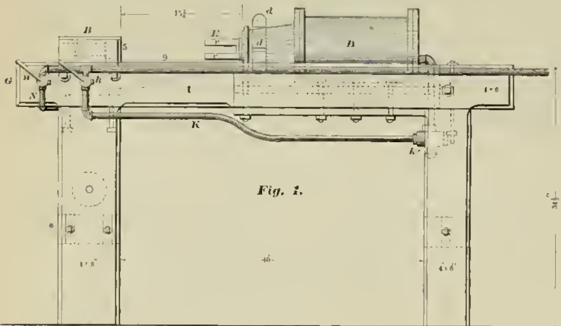


Fig. 1.

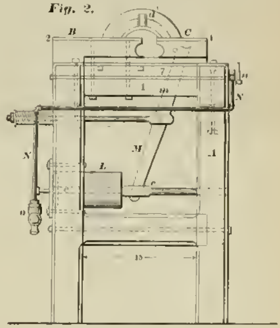


Fig. 2.

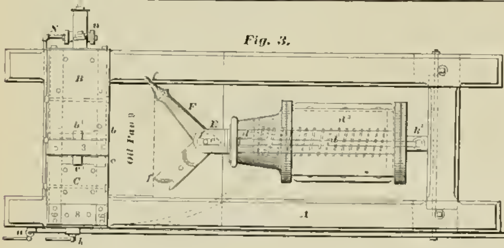


Fig. 3.

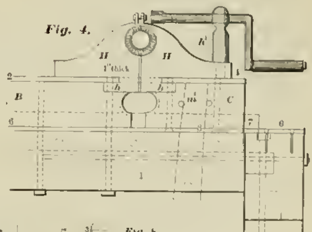


Fig. 4.

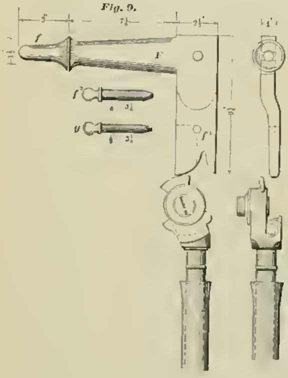


Fig. 9.

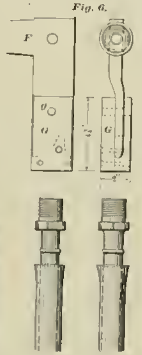


Fig. 6.

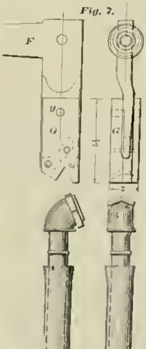


Fig. 7.

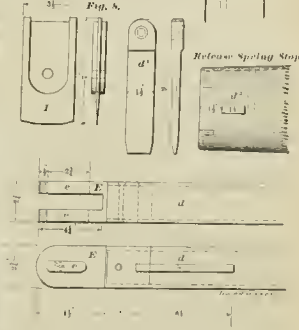


Fig. 8.

Fig. 1 is a side elevation, showing the position of cylinder and arrangement of operating levers. Fig. 2 is an end view, showing the hose holding vise and the small cylinder and levers that operate the jaw. Fig. 3 is a plan. Fig. 4 shows the hose clamp attachment, and Fig. 5 the knife used in cutting up hose from fifty-foot lengths. The other figures represent details on a larger scale.

The frame *A* is of wood, and the following additional specifications are given when duplicate machines are to be made.

Front cross-piece (1) framed to set down ¾ below top of side pieces. Block *B*, 3¾" thick, rabbeted on bottom to fit on cross-piece (1), and for guide bars (5) and slide (3) of block *C*, and firmly bolted

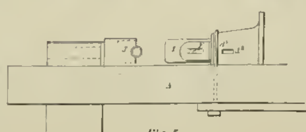


Fig. 5.

in side frame and on to cross-piece, the outer bar placed ½ from edge. Outside plate (7), ½ x2½ x 16", let into cross piece, bolted through as shown.

k and *n* are ordinary ⅜" pressure valves top removed and body turned down to fit pipe coupling.

The hose vise is long and has an enlargement in the slot at the end, to admit of the expansion of the hose when fittings are forced home; this vise will hold the hose under any end thrust without the use of a mandrel or filling piece.

The hose is laid into the slot in the vise flush with the front of jaw, the operator touching cock *n* admitting air to the small cylinder and firmly clamping the hose in position. The taper arm of ram *F* is introduced if the hose is hard and heavy, and a movement of the cock *K* forces it into the hose, enlarging it, if a coupling is to be attached, the end of it is dipped in oil, held in a pan directly under the vise as shown in plan, the end is placed against the hose and the forked fitting of *F* pulled up against the piece, this is made possible by the slot in the end of the piston rod, and prevents cramping or catching of the piece.

If a pipe fitting, either straight or angled, is to be attached, other forms of forks are used, as shown in Figs. 6 and 7.

All fittings are forced into the hose before clamps are applied and then all done at one time. A pair of steel jaws, as shown at *H H*, in Fig. 4, are fastened to the jaws of the vise—the hose clamps having been slipped over the hose before the last fitting was put in—the hose with clamp is placed against the stationary jaw of the attachment, and air is admitted to small cylinder. The points of the jaws engage the projections on the clamp, and leave the bolt lugs standing up clear; the bolt is introduced by hand, and the little socket wrench sliding in the standard *K* runs the nut up quickly, and is always in place for the next one; the nuts need only be screwed up to touch, as the vise has the hose clamp forced into the rubber.

The S. P. Company buy hose in fifty-foot rolls and cut it themselves. When this is done the bell crank fitting *F* is removed from the piston, and the knife *I*, Figs. 8 and 5, put on; a block of hard wood is fastened in front of the vise jaws to serve as a cutting block, and the long hose is introduced from the side of the machine, through a piece of pipe about two feet long, that serves as a guide and prevents the hose from laying out of the groove in cutter block; the hose extends past the knife to the proper length, where it strikes a gauge. A movement of the cock *K* moves the piston ahead and cuts the hose straight and clean.

The piston rod of the large cylinder is slotted, and a large key *d'* prevents the rod from turning around and disarranging the sockets or knife, when the latter is used the piston is turned around one-quarter of a turn, to bring the knife at right angles to the hose.

The boy who operates this machine does the work surprisingly fast and well, and with no hard labor. One of these machines on any road using air brakes or steam heat will pay for itself almost every time it is used.

The man formerly doing the hose work at the Oakland shop, and whose name we have mislaid, worked out the details of this machine, as he needed them in doing the work, and has applied for a patent on the combination.

There is probably no road in the country where as much attention is paid to the wishes of the patrons as on the Erie; this is especially true of the commuter patrons. No suggestion, request or complaint is ever ignored; a courteous letter is written to each correspondent, and if a request is refused, the reasons are given, all complaints are investigated, and the action taken communicated to the complainant, suggestions are accepted with thanks, adopted, if good and feasible, and if rejected, the reason for such action is given. General Passenger Agent Rinearson has an assistant in the shape of Mr. G. E. Allen, who is a professor of courtesy, and upon whom falls the lot of making people happy and contented. This policy has very largely increased the suburban business of the road, and bids fair to make the Erie the largest commuter carrying road out of New York, and is strangely in contrast with that of another well-known road, whose president told a committee of citizens who asked for a slight but necessary change in the running of trains, that he didn't care for the commuters—they were a d——n nuisance, except to burn coal that the company had to sell.

The Master Car Builders and Master Mechanics did very little about the M. C. B form of coupler this year. The M. M.'s simply resolved that it was a step in the right direction. It is now altogether likely that the link and pin will be left off of new cars on most roads, and the vertical hook substituted. No doubt more stringent laws will now be enacted to force the roads to use automatic couplers, but there is ten times as much damage done and lives lost because trains are not equipped with automatic brakes. Laws should reach for this point.

Micrometer Attachment for Calipers and Measuring Rods.

The illustration herewith shows a very handy little device, the invention of Mr. C. B. King, foreman of the Northern Pacific machine shop at Livingston, Mont.

The cut is full size. One end is slotted and a round hole bored into it, and a set-screw serves to make it fast to the end of a rod or the leg of a caliper.

The end screws on and off on a forty-thread

screw, and there are twenty-five divisions on the index, making each division one-thousandth of an inch.

Any mechanic can see where this little attachment could be used to advantage in measuring cylinders, etc., with rods. It is especially useful in tire or other work where shrinking fits are to be made and careful measurements necessary. It can be used on outside or inside calipers, on rods, or in almost any measuring device, where no provision is made for fine adjustment. It would pay some manufacturer of tools to put this little device on the market.

Locomotive Running Repairs.

By L. C. Hitchcock.

DRIVING-BOXES.

When an engine is undergoing general repairs, special attention should be given to the driving-boxes and driving-brasses, to see that they are fitted up in first class order. If any part of the work

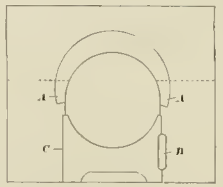


Fig. 1.

is slighted do not let these parts come in for their share, for nothing is more discouraging to a good engineer than to have his engine pound in the driving-boxes and brasses, and a renewal is the only remedy where the brass is too large for the journal, and if the box closes, or the wedge is not the proper taper, the play of the box between the shoe and wedge cannot be taken up by setting up the wedge. These evils can be overcome only by removing the box, which necessitates trouble and expense.

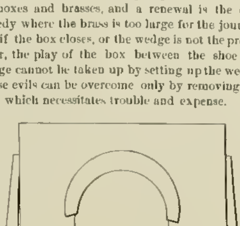


Fig. 2.

Some engineers, and foremen too, for that matter, in cases of this kind advocate planing the wedge until it has the proper taper to overcome the play of the box between the shoe and wedge. This I consider poor policy, for reasons which I will hereafter give. When an engine comes into the machine shop for general repairs, after having been in service for two or three years, the driving boxes, shoes and wedges are in a majority of cases very much in need of repairs; the shoes and wedges need lining and facing, the boxes will need planing, and the brasses will generally require renewing, or in case they are heavy enough they will be too large for the journals, or be loose in the box. When there is plenty of material in the brasses, and they are too large for the journals and loose in the boxes, it sometimes pays (when everything else is equal) to shim the brasses tight in the boxes, this will also close them to the journals, but in most cases this shimming does not pay. I think that the better plan is to put in new brasses while the opportunity is offered. Where the brasses to be renewed are of the solid pattern, in the form of a half circle, the box should first be planed out to a true circle, leaving the distances from the crown to the points *A A*, Fig 1, about $\frac{1}{16}$ inch greater on the side which is to go next to the hub of the driver; this will prevent the brass from working out of the box, should it become slightly loose, and this distance should be great enough to allow that part of the brass which rests in the points *A A* to be from $\frac{3}{4}$ inch to 1 inch below the center after the brass is bored to the required size. The outside of the brass should now be either planed in the slotter, or turned to the size that the box was finished, then the brass may be fitted to the box by planing from the edges which are to bear in the points *A A* a sufficient amount to allow the brass to go into the box the last inch at about twenty tons pressure; this will generally spread the bottom part of the box about $\frac{1}{16}$ inch. Now, at about the point represented by the dotted lines, and centrally between the flanges, bore a one-inch hole through box and brass on each side, and into these holes put brass plugs, making a good driving fit. The brasses should now be bored out to fit the journals before the cellars are fitted into the boxes. Boring the brasses generally allows the bottom of the boxes to close about $\frac{1}{32}$ inch, if the brass is put in under the pressure mentioned, and this leaves the top of box $\frac{1}{32}$ inch narrower than the bottom part; this causes the part which contains the cellar to be a trifle wider at the bottom than at the top, provided that the sides of this opening were originally planed parallel; this makes the removal of the cellar easy after it is started, even if it is very tight when up to place.

Some builders cast the boxes with a slot across the sides of the openings which contain the cellars, and in some cases these slots are also cast in the cellars. When the cellars are in place this leaves openings from side to side of the boxes, as shown at *B*, Fig. 1, and a rib at top and bottom of both box and cellars. I do not like this plan, for in replacing a cellar the top will strike against the bottom of the top rib on the box, if the cellar tips in the least. A good way to overcome this evil is to plane out about $1\frac{1}{4}$ inch wide from each end of each rib on cellars and boxes, liners can then be riveted on, of the required thickness to make the cellars tight in the boxes, and both sides of the cellars and boxes will appear as shown at *C*, and the cellars will be sure to go straight to their places, if entered properly. Now, fit the brasses to the journals, being careful to make that part which comes below the center of the journal, when the box is in place, exactly the size that the journal is in diameter.

After the brass has been brought to a general bearing on the journal, I think it a good practice to file from the crown a place about $1\frac{1}{2}$ inch wide and $\frac{1}{32}$ inch deep; this insures a good bearing on the sides to start with; after the brasses fit the cellars, and they being $\frac{1}{32}$ inch taper will go nearly up to their places before becoming tight, they should be fitted tight enough so that when they are up to their places the box cannot close a particle, and still not be tight enough to spread the box. Now, with the cellars in place, plane the shoe, and wedge bearing faces of the boxes, leaving each side an equal distance from the center of the brass, and perfectly parallel with each other.

Now, a word in regard to not being able to take up the lost motion of boxes between the shoes and wedges by setting the wedges up. As previously mentioned, the cause of this trouble is that either the shoes and wedges have not been planed parallel, or that the shoe and wedge bearing faces of the box are not parallel, the latter is generally the case. Now, if a brass is pressed into a box at twenty tons pressure, and the shoe and wedge bearing faces are planed before the brass is bored out, or the cellars fitted, when the brass is bored out the bottom of the box will close; this throws the planed faces out of parallel, and the box is in the condition represented in an exaggerated manner by Fig. 2, and, if the wedge has been planed square with the top of frame it will stand in the position shown at *A*, and any attempt to set it up will cause it to strike between the box and frame at the top, leaving the bottom loose, and, if the top is planed off to fit the box, it will be as shown at *B*, and the box cannot work freely between the shoe and wedge. Should a driving spring become weak, and let the frame down a little, the box will pound between the shoe and wedge, and should any unevenness in the track cause the box to lower, it will stick. But boxes sometimes get into the condition just described when the shoe and wedge bearing faces were parallel when the engine was first turned out of the shop, and this is owing to the cellar not having been fitted in the proper manner at the start, or having been filed smaller by some roundhouse man the first time the box was packed after going into service. I have heard of men reducing the cellars after the engine came out of the machine shop, so that they would not have so much trouble while packing them. This I consider very poor policy, for this reason: As the brass wears, the tendency of the box is to close in at the bottom, if it has been put in under sufficient pressure to hold it tight in the box, and when the cellar is loose the box closes to it, and the evils described are produced.

Allowing a driving-brass to run hot is a more serious thing than some engineers appear to realize, for it is sometimes, and where it becomes very hot it is in a majority of cases, followed by evils which can only be remedied by the removal of the box. The trouble referred to is the journal boring out the brass, and is produced as follows: The first things to become heated are the journal and brass. When heated, they expand; the box, being cold, does not expand, and is held tightly between the shoe and wedge, if properly fitted up, and does not give as the journal expands; the consequence is that the journal cuts its way in the brass until it has become free. Most engineers will remember that in most instances of hot driving-boxes small particles of brass will be seen, which have worked out from between the box and wheel hub. When the journal cools off it will resume its original size; the brass is then too large, and the journal will pound from side to side when the engine is working hard; but some one may say, "When a driving-brass heats and expands, the box will stick between the shoe and wedge, and a good engineer will at once pull the wedge down a little, to allow the box to work freely." True, he may do this, but this does not prevent the journal and brass expanding faster than the box, in which case the journal is sure to cut its way in the brass.

In some shops they take up the lateral motion caused by the faces of the boxes against the wheel hubs by planing from the inside flange of each shoe and wedge where it bears on the jaw, and putting a liner on the outside flange; this crowds the box towards the hub face, and takes up the lateral motion, but at the same time the size of the shoe and wedge has been thrown out of standard, and the spring saddle will not stand an equal distance from the inside and outside of the frame. I think that care should at all times be taken to keep all parts to a standard size, for where this is not done it causes much trouble where many engines are to be kept in repair. A better way to do in the case cited would be to measure the distance between the driver hubs, and from outside to outside of engine frames, and find whether the wear was from the face of the box or from the driver hubs. The liner should then be put where needed to keep all parts to standard dimensions. This is best, I think, even if the face of the box has to be planed off, or that of the wheel hub turned to allow for a liner of sufficient thickness to warrant it remaining in place.

While speaking of liners for this purpose, I will say that I have seen very good results follow facing the hubs of engine truck and driving-wheels, and also the faces of the driving-boxes with babbitt metal, and the difference in labor would, I think, make the use of this metal cheaper than turning and riveting on brass plates.

Baldwins are building twenty compound locomotives for South America.

Progressive Examination of Locomotive Engineers and Firemen.

By JOHN A. HILL.

SECOND EXAMINATION.

[*After Two Years' Service*]

Q. Are you sure you know all the signals in use on the road?

A. ——.

Q. Have there been any new ones introduced during the year, or any changes in old ones?

A. ——.

Q. What have you been firing?

A. ——.

Q. What is the general form of a locomotive boiler?

A. Generally a cylindrical boiler, having a fire-box of square section, surrounded by water, with tubes from it through the cylindrical part to a smoke-box on the front end.

Q. Why is the fire surrounded by water?

A. So as to present a large amount of water to the direct action of the fire, thus absorbing the heat.

Q. Tell me just what parts go to make up the fire-box.

A. The two side sheets, the crown sheet, the back sheet with furnace door set in it, and the forward or flue sheet, set full of tubes running to the smoke arch.

Q. What strains must the fire-box be constructed to withstand?

A. A crushing strain. The pressure is between it and the outside shell of the boiler, and tends to force the box in.

Q. How are the sheets of the box supported?

A. By stay bolts screwed into the outside sheet of the boiler, and through the fire-box, and riveted down.

Q. Is the crown sheet supported in the same way that the side sheets are?

A. In some classes of boilers they are.

Q. What classes?

A. In those with the outside shell of round section, the stays are spaced farther apart on the outside shell than on the crown sheet of the fire-box. They are on a radial line from the center of the boiler, and are called radial stayed boilers. Another form of boiler has a square fire-box, and the back end of boiler shell is also square. The direct stays in this boiler are straight. It is known as the Belpaire fire-box.

Q. What other form of staying is used on crown sheets?

A. Crown bars. These are heavy bars, generally set across the fire-box. They have points, or feet, at each end, bent down and resting upon the seam of the side sheet, keeping the bar above the crown a few inches. The bars are double, and a thimble is placed between them and the sheet, and a bolt goes through the sheet, the thimble and the bar, and is secured by a nut on the inside. The bars are then attached by stays to the shell of the boiler; these support the sheet.

Q. What are the objections to this form of construction?

A. It is hard to keep clean, is heavy and costly, and the bars occupy a great deal of the water space.

Q. What are the principal objections to the direct stay boiler?

A. It is a little more difficult to replace broken stays.

Q. What are its advantages?

A. It is cheaper to make, and gives a much better chance to wash out the mud and scale, and to inspect.

Q. How is the bottom of the fire box fixed?

A. The outside sheets and the fire-box sheets are riveted on the outside and inside of a heavy ring the shape of the fire-box, known as the foundation ring, or, more commonly the mud ring.

Q. What is below this?

A. There are iron grates across the bottom, with openings between them for the admission of air, and an ash-pan below them to catch fire and ashes that drop through.

Q. Has the ash-pan any other function?

A. Yes; it is usually fitted tight to leg of boiler, and has two more doors, or dampers, for the regulation of the amount of air admitted to the fire.

Q. Of what use is the cylindrical part of the boiler?

A. It carries the largest part of the water to be heated, and the tubes go through it, allowing much of the heat passing through them to be absorbed by the water.

Q. What is a wagon-top boiler?

A. One having the fire-box end larger than the cylindrical part, and connected to it by a cone or inclined sheets.

Q. What is the dome for?

A. The dome is a receptacle of steam, placed on the highest part of the boiler to insure dry steam, and is a convenient place to place the throttle valve, safety valves and other fittings.

Q. Is the dome necessary to the use of a locomotive boiler?

A. No; many locomotives are in use without domes.

Q. What must be the condition of the boiler to give good results?

A. It must be clean, its heating surfaces clear of scale or other foreign matter, and the circulation of the water must be good.

Q. What do you mean by circulation?

A. The movement of water in the boiler in such a way as to come in contact with the heated sheets, a fresh supply of water taking the place of that evaporated.

Q. What would be the result if there was no circulation in a certain portion of the boiler—say on one whole side of the fire-box?

A. The water in that place would be evaporated into steam, leaving the sheets bare, and they would become overheated.

Q. Suppose it did become overheated, what then?

A. If it became hot enough, and there was pressure enough on it, it would be forced off the stays and an explosion would occur.

Q. Suppose a crown sheet becomes bare and red-hot, do you think it would be more or less liable to come down if water were to suddenly be put upon it?

A. Less liable unless an excessive pressure were suddenly created to help force it down. It is the softening of the sheet by heat, and the pressure, that forces them down. Water cools and hardens the metal.

Q. What is the result if many of your flues stop up?

A. The boiler is robbed of that much heating surface, the draught is impaired, and the result is poor steaming.

Q. Why are the checks so far ahead on boilers?

A. So as to introduce the cold feed water the farthest from the fire, and allow it to become more or less heated before it comes in contact with the hot sheets of the fire-box.

Q. What hurt would it do to feed directly against the fire-box?

A. When the feed was off, the sheet would become as hot as the others around it, and when the feed was on, it would be cooled and contract, causing leaks, and perhaps cracks.

Q. Trace the flow of steam from start to finish when the engine is at work.

A. It is generated at or near some part of the heating surface, rises to the top of the boiler, enters the dome, and from there goes into the dry pipe through the throttle valve, into the steam pipes in the front end, and through the steam passage in the cylinder to the steam chest. From these it enters the steam port, when the latter is uncovered by the valve, and enters the cylinder, there coming in contact with the piston, which is forced away from the head by it. When the valve opens the port to the exhaust, the steam goes out of the same port which it entered, escaping under the valve to exhaust cavity in cylinder saddle, and thence out of the nozzle and the smoke stack.

Q. How many engines the same size as yours are doing the same work yours is?

A. ——.

Q. Which one has burned the most coal per mile the last year?

A. ——.

Q. Which one the last month?

A. ——.

Q. How much has yours burned?

A. ———.

Q. Is this any better than you have been doing?

A ———

Q. What sized nozzle has your engine got?

A ———

Q. Have you read Forney on the amount of water evaporated to a pound of coal, and the amount of fuel that should be burned per square foot of grate surface, and tried to compare your own engine's performance with it?

A ———.

Q. What is the brick arch used for?

A To aid combustion, thus preventing black smoke; it also prevents cold air from the furnace door from going directly into the flues, causing them to leak.

Q What is the extension arch for?

A To catch and carry sparks.

Q How is the draught regulated in an extension front?

A Usually by an apron, or diaphragm, extending from the front tube sheet, above the tubes, to a point about half way to the bottom of the arch. This is adjustable.

Q. How is the draught usually regulated in short-front engines?

A. Short fronts are usually fitted with diamond stacks, and these have a cone and nettings to break up and prevent the throwing of cinders. The draught is usually regulated by a lift-pipe, or petticoat pipe, placed between the nozzles and the stack. It is larger than the nozzles and smaller than the stack. Raising and lowering this pipe regulates the draught.

Q What is a safety valve for, and how does it work?

A A safety valve is a valve opening outwardly from the boiler, and loaded either by a weight or a spring, in locomotives usually a spring. This load is so regulated that when a certain amount of pressure is reached the valve and load are lifted and the pressure relieved.

Q Why are two usually provided?

A. For safety, in case one sticks or becomes inoperative.

Q. Tell me what a blower is for, and when it is a good and when a bad time to use it.

A The blower directs a jet of live steam up the stack, creating a partial vacuum in the front end and causing an extra draught on the fire. It is useful when a green fire is being urged into life. It draws away the dust and ashes when cleaning the fire, and prevents black smoke. It is a bad time to use it strong when fire is knocked out of box, or is partly dead, as it draws cold air into the tubes and may cause leaks.

Q Suppose your fire is old and somewhat dirty, and you notice, on opening the door, that the fire is dull red or of a bluish tint, but at once becomes lighter, often with slight crackling noise, what does that mean to you?

A I think that the bottom of the fire having become fouled by clinkers or ashes, prevents the admission of the proper amount of air for the fire, and the open fire-door supplies it. By leaving the door on the latch temporarily, the fire will burn better, but the clinker or ashes should at once be hooked or shaken out, so that air may enter through the grates.

Q. If the fire gets all the air it can use, isn't that enough? Why not leave the fire-door partly open?

A. The air must be thoroughly mixed with the gases given off by the coal, and this is best done through the grates and the fuel, as the jets of air are then broken up and thoroughly mixed. In opening the fire-door a large body of air enters and passes directly through the gases, only the outside mixing with them. This cools off the boiler.

Q How can you prove that mixing theory of yours?

A. By turning my scoop upside down in the fire-door, and on an angle toward the grates, the air is forced in a wide sheet down upon the fire and more thoroughly mixed, as is proven by the brightness with which the fire burns, it being possible to see all the grates in this way.

Q. What is the result if a hole gets in the fire?

A. Engine will lose steam, air enters in a large body, and goes through the tubes cold and unconsumed.

Q Why is it necessary to carry a thicker fire in one engine than another?

A. The harder an engine works her fire, the heavier it must be, to prevent tearing holes in it. Engines with small nozzles are more apt to pull the fire than those with larger ones.

Q. What is the best way to regulate the steaming of a locomotive?

A. By the fire.

Q. How?

A. By using as light a fire as can be made to stay on the grates comfortably, and breaking the coal in proportion to the depth of the fire.

Q Explain that point.

A If the fire is very thin, it is necessary to break the coal pretty small in order to insure combustion, and to break up and more thoroughly mix the air entering through the fuel. If the fire is thick, it must be coarser, or it would shut out the air altogether.

Q Is it possible to admit too much air?

A. Yes. All air admitted above that necessary for combustion cools the gases and helps keep them below the igniting point.

Q. How much air should be admitted then?

A. That depends upon the amount of coal that it is necessary to burn. If the train is light, and little coal is burned per square foot of grate per hour, it will sometimes be better to close one damper; but if the fire is being forced hard, and a large quantity of fuel burned, air must be admitted in proportion to the fuel used.

Q. What would be ideal firing?

A A constant supply of fuel and air.

Q Why is this impossible?

A. Because fuel is fed by hand, and the supply is intermittent, and because enough fuel must be kept on the grates to prevent tearing of the fire. If the fire door is opened, and a large quantity of fuel put on, it cools the gases below the igniting point, and gives off little effective heat until the mass becomes heated. On the other hand, if a very constant firing is kept up, the air admitted at the door will do the same thing, so that the fireman must stand between the two extremes. The only thing to do is to keep fire enough to prevent pulling, and then regulate the supply of air as will give the best results.

Q. Taking a hard-working soft-coal engine, do you think it practically possible in road service to admit too much air through the fire?

A No. It will be almost impossible to get enough, and if some air is admitted above the fire it will produce more perfect combustion, provided it is broken up and mixed with the gases. Perforated doors and hollow stays do good in cases of this kind.

Q What is the difference between hard and soft coal for use on a locomotive?

A. Hard coal is almost entirely composed of carbon, giving off very little gas, and its use is simpler; it is not so necessary to admit air over the fire; the flame is short and intensely hot; a long fire-box is necessary in order to burn a large quantity at a time; as it gives off little gas, there is no smoke to speak of.

Q Are you on good terms with your engineer? Do you talk about the engine or the work, and do you see the orders, and know what trains you should meet or pass?

A ———.

LECTURE.

I recognize the fact that the past year has been one of hard work for you, and one that has not given you much time for study. But if you read a little each week or month, and then compare the theories laid down by good authorities with your daily work, you will soon have a very large fund of practical information based on proven ground.

I have directed your thoughts upon boilers and combustion, because it is of the greatest importance to the company and to you. If you are reasonably careful, you can save many dollars by so firing as to prevent wasting steam at the pops.

Next year I will examine you upon the mechanism of the locomotive, and ask you what you would do under every circumstance of breakdown that I can think of. There is no occasion for you to learn a lot of answers to a lot of set questions relating to breakdowns. What you want to do is to understand the general plan and principles of a locomotive, to know what each individual piece does, and what part of the complete machine it is, remembering that a locomotive is *two* steam engines connected by the axles and steam pipes only. If you understand the principle of the thing you cannot be "stuck" on a question if you stop to think—and I shall not hurry you.

I want you to remember that the business of the road is to transport freight and passengers with the least expense and delay, and that the engineer is the brains of one great engine. It is not to the interest of the company for an engineer to spend hours and cause long delays to show his skill or ingenuity in patching up a broken engine, when he could have been towed in in half the time. At some time, and under some circumstances, it might be best, under others worse; the end must justify the means.

Good judgment is the most essential thing in a successful engineer. I shall ask you many questions about maintaining your engine, but I shall expect you to know only as much as concerns you as a runner—you are not a builder. But if you say you would key rods or set up wedges with the engine in a certain position, I shall certainly want to know *why* you do so. Study the *why*.

Keep up your reading of current literature on locomotives. You will find something each month that you did not know before or had forgotten. Should you pass the next examination satisfactorily, you will be given a note to the superintendent for examination on time-card and rules. Passing that, your name will be entered, in its turn, on the list of extra engineers, and I trust that in time you will be in charge of a locomotive.

(Final examination questions next month.)

The Cheapest Fare in America.

The Southern Pacific Company doubtless run some trains on which the least fare is collected in this country.

The main station at Oakland is on "the mole," a long fill extending some two miles into the bay. Passengers reach it from San Francisco by a four-mile ferry. There are several stations in Oakland and suburbs, and a great many suburban trains are run in several directions. The trains run right through the business streets, and by some agreement made in securing the original franchise, the company is debarred from collecting fare in Oakland. People who come over in the boats pay 25 cents for a round trip, and can get off at any station in Oakland.

It is a regular thing for people of all classes to crowd upon the trains going and coming, and use them just as they would free street cars. Nurse girls, with three or four children, and young people, out for fun, ride back and forth over several miles of track, and no fare is asked.

The road also runs a number of "laborers' trains" between Sacramento and San Francisco, 135 miles, the fare being very low—$1 50, we believe. This is also one of the original promises that the company would like to get rid of, and therefore accommodations are rather meager. The seats are all plain pine boards, in the oldest and poorest coaches, and the seat backs are boards only about ten inches high.

It is cheaper for a tramp to have a state-room on this train than to ride on a truck.

Didn't Believe in Wear and Tear.

"I distinctly remember the first summer this road started," said a D. B. G. foreman to the writer as we stopped where some men were loading links and pins—"I distinctly remember that Superintendent Borst sent up a writen order for two dozen links—that wa'n't many—but old Uncle Johnnie Greenwood, the master mechanic, shook his head, and asked me if those twenty new flat cars didn't have links come with them, and when I said they did, he said: 'Let 'em take care of them then; we won't make any.' Now we use two car loads a month, and everything else about the road has grown in proportion."

Correspondence

Early Lake Compounds.

Editor The Locomotive Engineer:

I beg to correct you in regard to the first marine compound used in this country. In October, 1845, I was a passenger on the side-wheel steamer "America," from Chicago to Buffalo, that had a compound engine. It was horizontal, and from recollection, the cylinders about two and four feet diameter, and eight to ten feet stroke, what might be called a steeple compound laying down; it had no condenser, as I recollect. The engineer claimed it saved nearly half the fuel. It made the run to Buffalo in less than four days, which, at that time, was considered very smart. I remember we raced with the larger steamer "Wisconsin," and passed her easily. The "America" was a new boat; this was her first or second trip.

The steamers at that time were nearly all side-wheelers. ALLEN WOOD,

General Manager St. A. & S. B. Ry.

St. Augustine, Fla.

Dip for Cleaning Rough Brass.

Editor The Locomotive Engineer:

In your June issue I noticed the following in the Question column:

"Is there a mixture of acids called bright dip, that will polish rough brass without file or lathe? If there is, please publish the formula."

The following receipt gives good results. It does not polish rough brass, but it gives it a very neat appearance, and answers for many purposes as well as if it were polished.

Sulphuric acid, 12 pounds, nitric acid, 1 pint, niter, 4 pounds; soot, 2 handfuls, brimstone, 2 ounces; pulverize the brimstone and soak it in water one hour. Add the nitric acid last.

For cleaning injectors, checks, pump governors, reducing valves, etc., we use the following.

Strong nitric acid in sufficient quantity; dip the brass in the liquid for an instant, withdraw, and immediately immerse it, first in cold water, then in boiling water, for a short time only in each bath, then allow it to dry. Repeat the process, if necessary. T. B. PURVES, JR.

East Albany, N. Y.

Getting Things Right.

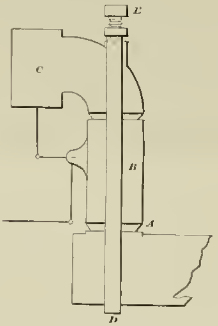
Editor The Locomotive Engineer:

The thought has often occurred to the writer that if some of the men who design locomotives had to do the running repairs they would get things into a different shape from what they do. Of course, construction is sometimes complicated, necessarily, but there are times when the location of parts could be better arranged and made easier to get at.

Take injectors as an example. How often are they stuck down in the corner of the cab in a dark, hard-to-get-at place? It is not much of a trick to put them there when new, with the proper wrenches and other tools at hand, and all nuts easy to turn, but when it comes to doing repairs, it is another thing, every nut is tight and immovable, no proper wrenches to work with, and ninety-nine times out of a hundred the injector is hot, and it is generally managed to have the overflow pipe where nothing but cuss words and a hammer and chisel will do any good. I once saw an injector placed back of air-pump, when injector required packing, had to take down air-pump to do it.

The greatest evil of them all is to locate the air-drum under the footboard. If there is anything that will start a man to swearing it is to have to work under an engine setting up wedges, packing cellars, etc., and butt his head against the drum, it is an imposition, backed up by indifference, and in some cases ignorance, on the part of the man who will put an air-drum under the footboard. They are bad enough under the boiler, forward of the links, but that is not the place for them. Put them in the coal pit of tender, or on top or back end of tender, anywhere but about the engine. Why not put them on the top of boiler in place of sand-box, and put sand in wheel cover? The late A. J. Stevens, of the Central Pacific, combined his air-drum and sand-box in one, on top of boiler of his local engines running in Oakland, Cal., and they were all right.

Some builders should be ashamed of the way



the dry pipe connections are made in boilers. A dry and stand pipe, properly made, will have a ball joint on its top side A at back end, with the stand pipe B ground in to make the joint; with the throttle case C ground on the stand pipe, and with the stirrup D passing around the dry pipe and up around the stand pipe, and with a single set-screw E, the joints are both made at the same time, and the set-screw is get-at-able. This may not be new, but it is much better than standing on one's head in the dome trying to knock out split keys or unscrew nuts to get the thing apart.

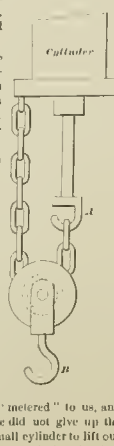
Corry, Pa. W. DE SANNO.

[It may be more convenient about doing work under an engine to have the air-drum on the tank or top of boiler, but that is a bad place for it, just the same. The drum should be the lowest point in the air-brake system, so as to trap all the moisture where it can be drained off. With the drum high, the hose between engine and tender become traps for water and oil that it entrained, and causes trouble from freezing and rotting out hose.]

Increasing the Power of a Lift by Reducing the Speed.

Editor The Locomotive Engineer:

As in many other locomotive repair shops, we are obliged to use our driving wheel press for tender and truck wheel work. A chain block did very well for handling them, but it took three men to do it, and not make very good time either.



After the city water was connected with our shop system we abandoned the chain block, and replaced it with an 8-inch cylinder of sufficient length to elevate a pair of our smallest wheels. Our city pressure is about 60 pounds per square inch, and with a cylinder of this size we could manage our largest and heaviest tender wheels with ease, but could not lift a pair of driving wheels.

If we had increased the diameter of our cylinder to accommodate the driving wheels, it would have required as much water to lift a light load as a heavy one, and as we handle fifty trucks to one pair of driving wheels, we concluded the small cylinder would be the most economical, as our water is "metered" to us, and paid for by the gallon. We did not give up the idea, however, of using the small cylinder to lift our heaviest drivers into the press, and the sketch I send you illustrates how we did it.

Some of the boys were positively sure that no greater weight could be lifted by hook B than by hook A, and watched with much interest when B lifted driving wheels as easily as A lifted the truck wheels, the speed, of course, being reduced.

When not being used for driving wheel work the chain is disengaged from cylinder and hook A, and hung over upper bar of press.

There is nothing new in this, of course, but I thought it might interest some of your readers, as it illustrates a mechanical law.

The same principle was applied to get a heavy teaming truck out of a mud hole in which it was stuck.

The driver worked and urged his team for all they were worth, but no go, they could not budge the load. There were many suggestions from the crowd that had gathered on the street, and one young fellow was willing to back his suggestion—that he could pull the load out with one horse—with a five-dollar bill. The attention of the owner of the team was called to it, and he offered to give the young man five dollars if he was successful.

This is the way he did it: Detached both horses from the truck, and around the hub of each forward wheel took as many turns with a ⅝-inch rope as the length of the hub would admit, and to the other end of the ropes he hitched the traces of one horse. Betting was very lively as to whether the horse would pull it out or not, but at the first word he started, and out came the load with scarcely an effort, and he did not stop until the rope had unwound from the hub.

The owner gave up the V, but considered it worth five dollars to learn the kink.

East Albany, N. Y. T. B. PURVES, JR.

Another Pump Problem—A Bent Piston Rod.

Editor The Locomotive Engineer:

A short time ago one of my 8" pumps got to groaning very bad, and all the swearing and valve oil the engineer used would not stop the groaning. So I concluded that a wing of one of the air valves had broken off and got under the air piston and bent the rod. Well, I took off the bottom head, then removed the air piston, but found nothing. I then examined the air valves and found them all right. I then took off the top head to examine reversing valve plate bolts, and found them all right. I then took out the piston and rod to see if it really was bent, and it was. The piston rod was perfectly true when it was put in the pump. Now will some one tell me what bent that piston rod close to the steam piston head? I discovered what it was that bent the rod, but not until I had done lots of thinking. W. F. RELYEA.

Syracuse, N. Y.

By the Way.

Editor The Locomotive Engineer:

If I were asked for a definition of a valuable correspondent to your paper, I would answer, he whose article some other correspondent takes exception to. I often wish, while reading, that I could meet some of your live correspondents, see what kind of men they are.

Would go a hundred miles to see John Alexander, heard a mother say last evening, "If I only knew his address I would write and thank him for the good his letters have done Ed," (her son), but nobody takes exceptions to what he says.

It is different with some others, a few days ago I was at Houston, Texas, started out to get acquainted with Mr. Campbell, whose articles on Traveling Engineers and Valve Setting have been numerously criticized, if not answered.

At the office I met a pleasant-appearing gentleman of perhaps 48 or 50 years, who during a twenty-years' residence in the Sunny South has lost none of the git-up-and-git that has taken to the front so many other Ohio men.

I started to get on the good side of him by asking if he needed the services of a traveling engineer, with a snap that a pop valve would envy, he answered "No sir, no sir, I don't want a traveling engineer."

I next told him that I had experience in setting valves; this seemed to interest him, as he asked me how long it would take me to set the valves on an engine. I told him that I had done it in nine minutes and thirty seconds, beating by half a minute the best time recorded in THE LOCOMOTIVE ENGINEER.

He asked me where I was from, and when I said Colorado that settled it. With a pleasant smile he grasped my hand and said that some time past he had sent the road's champion liar out to Colorado to see some kinks he had heard of, but that he had only staid a day, and on coming back he reported that a champion liar from Texas was only an amateur in Colorado, assured me of the pleasure he had in meeting me, and that his time was at my service. I gladly availed myself of his offer, and was repaid by being shown, not the largest, but the neatest shop that I have seen in Texas; and let me say that the railroad shops of Texas are models of neatness within, and many surrounded with beautiful gardens of flowers.

After an hour spent pleasantly I left and *sized* him up as a man who is proud of his business, takes a live personal interest in his men, expects and exacts faithful services, and when rendered does not fail to let them know that it is *appreciated*.

Denver, Col. A RAMBLER AFTER KINKS

Injector Puzzles.

Editor The Locomotive Engineer:

Considerable information has been gained by the pump problems published in your paper, and I have been expecting some one to commence propounding questions on injectors; and as the rest appear backward, I will submit one or two—just for a starter.

Take the Sellers of '76. Suppose you can prime, the water raises readily to overflow, but the injector "flies off" or breaks—what is wrong?

Suppose you prime as before, but when you pull out spindle to force the water to boiler, the injector "breaks." There are three causes for this action, and all easy enough—what are they?

Wilmington, Del. EDWARD GIBSON.

The Master Mechanics Association.

The regular June meeting of the American Railway Master Mechanics Association was held the third week in the month at the Stockton Hotel at Cape May, N. J., and was the largest gathering the association has yet held, and the twenty-fourth in number.

The week preceding, the Master Car Builders held their meeting at the same place. Their meetings are not so interesting as the master mechanics', but are of as much or more importance to the railroads, on account of the interchange of cars.

The standards of this association have saved the railroads hundreds of thousands of dollars and the public lots of delays and loss, still, it is more than likely that it will, sooner or later, be merged into the master mechanics', for the simple reason that, within the past decade, car building as a separate department has lost its standing, and the office of car builders has been merged with that of master mechanic; this may be, and probably is, all wrong; the responsible car builder should have credit for his work and be the head of his department, but it's too late now—in ten years there will be no car builders, pure and simple.

The convention opened this year by a speech from a local politician who was chock full of welcome, but not much of a speaker; then President John Mackenzie got in his fine work, making his speech short and all point. The roll call shows a membership of 458, ninety five having been added during the year.

The first paper read was on Exhaust Pipes and Nozzles.

The committee report actual experiments with single nozzles exclusively. We quote from the report:

"We hold that the aim of the designers should be:

"1st. To choose such size and shape as to secure free steaming.

"2d. The exit of the steam should be as free as possible, to avoid injurious back pressure.

"3d. The discharge should be as nearly central with stack as can be, so as to produce maximum effect.

"4th. Exhaust from one cylinder should not blow over into the other.

"5th. The exhaust pipe should terminate at such distance from base of stack as to insure its being completely filled at each discharge.

"In designing single pipes we hold that the most vital point is the relative areas at tip and at combining point. Where the last-mentioned point is largely in excess of the other, it will inevitably result in blowing over the bridge, raising the back pressure line into the well-known hump.

"On the other hand, where the area at tip is the larger, it will be found that the velocity given to the steam at the bridge will, provided the form is easy, carry it past the tip without any tendency to blow over. Not only is this so, but the contrary effect will be at times observed—*i. e.*, there will be a partial rarefaction in opposite cylinder, as will be shown in indicator cards.

"It has been clearly shown that the height of the bridge cuts no figure in effecting back pressure, but that lowering the bridge affords the designer a chance to straighten the discharge before it leaves the pipe.

"We suggest that the distance be made from three to four and one-half times diameter of tip. Also that sudden changes in form be as far as possible avoided, both from the increased resistance to free exit, and also because the eddy caused by sudden enlargement or contraction causes deposit of gas carbon from cylinder oil at those points.

"We do not think that the pipe should be regarded as a reservoir, because such treatment so prolongs the discharge of the steam that the pressure is not relieved when the piston begins return stroke.

"We consider that the pre-release affords ample time to discharge the steam. The height of the pipe should be such as to insure that the base of stack shall be completely filled at narrowest part. If, however, it be more than filled, an injurious eddy is formed.

"We think that the general practice is to put the pipe too high. Where care is not taken to insure straight discharge, part of it impinges against side of stack with injurious results to steaming. Raising the pipe, of course, obviates this trouble in a measure."

The subject of Testing Laboratories was next subject of report, and a very exhaustive report it was. It gave the cost for a testing department complete, and gave figures from several roads, showing a large percentage of material condemned by the inspectors.

The relative value of steel and iron axles then came up, and a great diversity of practice was shown by the discussion.

The committee on the subject of Feed-water Purification gave the replies of many to their circular, and tell of a dozen of things tried for this purpose, most of which are condemned. They end their report as follows:

"To sum up the information, your committee gleans the fact that up to the present writing the efforts to purify the foul water, and soften the hard waters, especially for locomotive boilers, have proved unavailing, and there is still much room for experiments in this direction. The sentiment of those who have expressed themselves is in favor of a mechanical device, as against the use of chemicals or compounds. Your committee has not the information at hand that would warrant the recommendation of any device, but directs attention to the Barnes Mechanical Device, which, from a mechanical standpoint and the evidence before us, warrants us in taking this action.

"The evidence is preponderant and almost unanimous against the use of chemicals or compounds, while with the use of oils there is ever danger unless the greatest of care is exercised in placing it in boilers, as it cannot be surmised what mischief it is working by adhering to crown sheet or other parts coming in contact with the fire. Your committee is skeptical on this point, having personal knowledge of the damage arising from such practices."

For all of this we are inclined to think that railroad master mechanics have been giving their boilers medicine without knowing just what was the matter with them. They have tried pretty nearly everything that came along. To know how to get impurities out of water it is first necessary to know what is there to get out; no compound or no mechanical device will work well in all waters, any more than one sized hat will fit all men. It would be folly to use a compound in some waters that a purifier might help greatly, and *vice versa*.

The old question of the Standard Car Coupler then came up, but there was less discussion than was expected, and a resolution was finally adopted stating that the coupler was a step in the right direction—practically an indorsement, but done half-heartedly, as if they were a little ticklish on the subject—which, no doubt, many of them were.

The committee on the Examination of Engineers and Firemen made an exhaustive report. Early in the year they sent out a circular to the heads of the motive power departments of our roads, asking the following questions:

No. 1. Do you examine engineers employed from other roads on anything except time card rules? If so, what plan do you pursue, and of what does the examination consist?

No. 2. Do you examine firemen candidates for promotion? If so, what line of examination is followed?

No. 3. In hiring men for firemen, what age do you consider the limit past the age of 21 years?

No. 4. Do you advise the first year in service, as fireman, be on switch engine?

No. 5. What do you consider the shortest time a firemen should serve in that branch of service before he is allowed examination for promotion to engineer? If fireman fails in examination, how do you deal with him?

To these some fifty replies were sent, and from the average replies the following deductions were made:

Q. 1. (a) When possible, such as old roads, trunk lines, etc., it is not considered best to hire engineers, as such, from other roads, but to make or educate their own engineers from the ranks, and by so doing have men that are better adapted to the requirements of the particular service required; a better opportunity is afforded for more intimate and satisfactory knowledge as to the character of the men, and does not place any hindrance to the best incentives and inducements for men in the ranks who are looking and working toward the higher positions.

(b) But when, such as new roads and isolated systems, it is not possible to educate or make all their own engineers, it is deemed best to give applicant same examination as to firemen candidates for promotion; in addition to this have to furnish satisfactory evidence of character and disposition from the roads where the applicant has been employed.

Q. 2. Except in a very few cases, many general replies have been given to this question, stating that applicants for promotion were questioned and carefully examined, but not stating any particular form, merely citing questions that would illustrate the general form or method used. Several elaborate plans of examination were here mentioned.

Q. 3. The majority favor as a limit past the age of twenty-one years, not over twenty-eight years.

Q. 4. Twenty-five out of forty-seven favor first year's service as fireman to be on a switch engine.

Q. 5. The almost unanimous opinion is that three years is the shortest time a fireman should serve before being allowed examination for promotion as engineer, and it is quite the general opinion that applicant should be given one or even two additional opportunities, being set back on the list if he fails to pass examination for promotion, and are all quite agreed that if he fails on these he should be dropped from this branch of the service entirely.

We quote from the report:

"A great deal has been said against having fixed sets of questions for use in examination of applicants; that the men would learn the answers to the questions, etc., and thereby defeat the object or purpose of the examiner. Now, it seems to your committee that this objection is more apparent than real, for the examiner is not compelled to rigidly adhere to the set questions, but is at liberty to vary them as the circumstances demand; and as to the applicant committing the answers to the questions, or getting helped by the others, etc., is this an objection? The bare fact of the applicant so applying himself as to commit the answers is in itself a great point gained, and the examiner can readily determine whether the applicant has an intelligent conception of the matter involved in those questions or answers.

"A great many of the forms of questions furnished from time to time are so elaborate or intricate that an expert mechanical engineer, or even master mechanic, would make sorry work with them. The idea of the questions is not to puzzle or trip the applicant, but to determine if he has sufficient knowledge of the machine he is to have in his care to satisfy the requirements of service

"The idea of progressive examinations, as advanced by Mr. John A. Hill, associate member, is so *apropos*, and withal based on such practical and common-sense grounds, that your committee cannot refrain from presenting a brief synopsis of same in connection with this report."

Here follows a complete outline of the plan of progressive examinations as proposed in this paper, the report ending as follows:

"The plan covers the whole field from the preliminary to the final examination for promotion, advancing step by step, and is well worthy of careful study."

This report was received without discussion.

The subject of Operating Locomotives with Different Crews was then taken up. The committee thus state the advantages and disadvantages of using more than one crew on an engine.

"The advantages of operating locomotives with more than one crew are that it saves a large investment of capital in power, decreases the amount of fuel wasted in housing, banking fires and restarting them, and saves roundhouse room and fuel and plant for warming them in severe weather, where there are an unequal number of trains in opposite directions, the pool system gives the men exactly equal hours of rest and equal work By the double-crew system almost as much service can be secured as by the pool system, but not as even chances for the men.

"The greatest disadvantages of the pool or chain-gang system is that it relieves the engineers of the sense of responsibility; they lose all interest in the care and maintenance of the engines, and in consequence less miles are made between overhaulings than where the men try to maintain the power It is almost impossible with any double-crewing system now in vogue to fix the responsibility for the results of misuse or carelessness, such as cut journals, valves, etc It is difficult for the firemen to learn the peculiarities of steaming of the different engines. The engines are not properly cleaned, and no incentive is offered to the men to be economical in the use of fuel or supplies. The inspection and cleaning usually attended to by regular crews is in pooling an extra expense.

"The double-crew plan leaves the care of the engine between two crews, and the entire sense of responsibility is not lost, but it is a very difficult matter to arrange the runs, especially on freight, so that the division of hours of labor and rest are equal among the men. And the details of arranging and changing runs are very annoying and unsatisfactory."

We quote further

"The tendency of modern operating is turned toward doing the most business with the least investment for power possible, and it is more than likely that none of the large lines will own engines enough to man each with a single crew and do the work.

"Your committee is led to believe that pooling can only meet with success where particular attention is paid to the inspection and repairs; in fact, where they make special provision to care for the engines, as they do on the P. R. R. No road can hope even for comparative success, handling the work as they would where engines had their regular crews.

"In passenger service your committee believe that the double crew plan is better than the pool system; the runs can be more evenly distributed, and the double crews do not lose their sense of responsibility or relax their care of fuel or stores.

"In freight service it is a very difficult matter to arrange the runs for double-crewing, and where many 'extras' are run, and the seniority of engineers call for the best runs, it is well nigh impossible.

"Where pooling is found necessary, even temporarily, your committee are of the opinion that better results will be secured if extra wipers and cleaners are put on to clean all engines fairly well in a few minutes while the fire is being cleaned, the tank and sand box filled and the engineers oiling around. Hostlers should be provided at terminals and engine taken to a track where all this work can be done at once; at the same time the hostler and his helper should take off the oil and clothes-boxes of the crew that brought the engine in, and put on the private boxes of the men who are to take her out, boxes specially designed for handling should be provided. The oil and supplies should be charged to the *crew*, and not to the *engine*; this provides a check for wastefulness and is an incentive to be reasonably economical.

"Blank reports should be furnished and each engineer be required to turn over one to an inspector on arrival; this, in addition to reporting the work necessary, should contain a few questions, that could be answered by 'yes' or 'no,' that will show the general condition of the engine, how she steams, condition of brakes, and whether or not the engineer considers her in condition for further service without repairs.

"Inspectors should be provided at all changing points, these men should be selected from the most experienced and careful engineers, and no work should be done on an engine without the approval of the inspector"

The question of the Best Form of Heavy Engines for fast service came up, and a long report was submitted. The discussion was principally whether the ten-wheeler or the Mogul was the best form. The discussion brought out the fact that there was almost unlimited faith in the safety of the pony truck. The report ends as follows:

"As a summary we would say, from all information furnished, we gather that the preference is for the ten-wheeled engine as against the Mogul, on account of its being practically the same as an eight-wheel, the forward drivers being simply burden bearers, and leaving wheel bases actually the same. Next because the distribution of weight is such that, while gaining sufficient adhesion to utilize all the power, there is not an excessive weight on either wheel. For example, an engine properly proportioned for 20x24-inch cylinders at high speed will weigh about 130,000 lbs. On a ten-wheeler this would give 32,000 on truck and 98,000 on drivers, while with a Mogul we would scarcely put more than 20,000 on pony, leaving 110,000 or, perhaps deducting 2,000 for difference in construction, 108,000 to divide on six drivers. While this weight would not perhaps be destructive to track, it is more so than the 16,333, besides being useless. Again the majority claim greater safety on crooked roads for ten-wheel engines

"In conclusion, the committee would say that the relative economy of these engines in fast service, as against eight-wheel, could better be answered in the future than at present, with the limited actual experience we now have.

The committee on Standards of the Association made a very sensible report, from which we condense the following:

"The principal business of the members of the association is connected with the construction, repairs and operation of locomotives, and this work is confined to a system of roads operated by one company, or to a single, independent road The locomotives in their care not being interchangeable with other roads, and its operation and the care of it being confined to the road which owns it, we regard it as highly important that each road should adopt standards of locomotive construction best adapted to the service required, and the geographical position in which they are located, but we do not regard it as essential that the standards of all roads should be the same."

They believe nothing should be adopted as a standard until all are agreed that no improvement can be made; as the adoption of imperfect standards by this association would have the tendency to prevent the investigations which it is our object to encourage

They recommend the following:

"United States Screw Threads, Micrometer Gauge for Sheet Metal, Limit Gauges for Bar Iron, and Gauges for Driving-wheel Centers and Tire These standards and others of a like nature which may be added are important in our dealing with manufacturers, and the general adoption of these will be in the interests of economy, and your committee would recommend that they be maintained and reaffirmed as standards of this association. But the axles for light and heavy tenders and the tests and specifications for cast-iron wheels should not be standard, but should have the indorsement and recommendation of the association, to be adopted by the members as they may see it to the interests of the road they serve. Of the Journal Bearing, Journal Box and Pedestal, these standards were adopted by a joint committee appointed by the Master Car Builders and this association, and your committee are of opinion that it was proper to approve the recommendation of that committee, but that it should not be regarded as a standard of this association. The only other standard which has been adopted by this association is that of making 6 miles per hour the standard mileage for engines in switching service. The committee think this is the general practice, and should have the recommendation of the association, but it is not of sufficient importance to be placed on the list of standards."

The committee on Air-brake Standards and Care of Air-brake report in favor of publishing a book of rules on the subject, said rules to be printed by the Car Builders and Master Mechanics Associations to insure absolute uniformity This subject was left over for one year, as the rules submitted covered only the Westinghouse appliances, and it is designed to make it cover all.

The association owns something over $8,000 in bonds, known as the "Boston Fund," from the fact that it was started in that city, they have no use for the money, and it has long been a white elephant on their hands The association have now agreed to buy four scholarships in the Stevens Institute of Technology, and give them to the sons of members or widows of members who can pass the best examinations before the public shool officers. In event of more applying than there are scholarships, those passing the best will be given the scholarships. This will dispose of the fund, do some good, and ought to make four living monuments to the association, and will be, no doubt, an honor not a little coveted

The noon hour discussion brought out a great many points on the compound locomotive, and developed quite a debate on the relative advantages and disadvantages of the four-cylinder and two-cylinder types. It was shown that there were upward of seventy compounds built in the U S in the past eighteen months.

Mr. Forney stirred up quite a discussion by saying that he never knew of a case where the application of an indicator had done any good to a locomotive. Those who know Forney best say that is his way of awakening interest—it is not a bad one

There was also much interest taken in the discussion on the proper heat for flanging steel, some specimens of boiler steel were shown by Mr. Blackwell, that were bent double and hammered down cold at one end without a flaw, while the other end was badly cracked at a dull red heat It was the unanimous opinion that boiler steel should be flanged and bent only at a bright red heat.

The next meeting of the association will probably be at Saratoga.

Steam Heat Suggestions.

The Master Car Builders' Committee on Steam Heat recommend that:

1. That all pipe as far as possible should be located inside the car

2. That a uniform location should be adopted for the ends of the pipe between cars

3 That a standard pipe union or corresponding device should be adopted for connecting the rubber hose with the train pipes.

4. That means for heating cars independently should be retained.

A Chicago paper says that the Duluth, South Shore & Atlantic Railroad has a scheme on foot which includes a new line of steamers. The plan is to connect Lake Superior with the Atlantic Ocean, the terminal cities being Duluth and Norfolk, Va. One of the connecting links of railroad, the Columbus, Lima & Milwaukee, has just been bought.

Locomotive Engineer

THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS

The Trouble with Manufacturing in a Repair Shop.

It used to be an easy matter in years gone by for those in charge of the machinery departments of railroads to build locomotives, machine tools or what-not, charging the bulk of the expense to running repairs, and thus make a showing of cheap work.

Many a man has been permitted to build engines of his own peculiar kind by making the claim that they were cheaper than those on the market.

Now there is a different system of doing business. Directors and stockholders want to know how much it costs per mile to run their engines, cards showing the results are exchanged by the larger roads and comparisons made.

The average manager, stockholder or operating head seldom looks farther than the pay-roll—that must be kept down

The man who makes his own locomotives, machine tools and what-not, has a big pay-roll and has to be cut down, while the one who buys everything he can, keeping only men enough in the shop to keep up running repairs, gets along the best, has the better reputation—and, usually, better rolling stock

No master mechanic can afford to do much manufacturing; it may be a satisfaction to him, but it is sure to be expensive, and put a load upon his department that he will get no credit for, and indeed he is lucky if he is not condemned as "a good man, but too expensive."

You may know that you are saving the company money, but remember that the average stockholder and director are blind except as to the size of the pay-roll—keep your eye on that

The Value of Failures.

There are some kinds of mistakes that human nature insists on making in each individual case, and no amount of experience of others will prevent constant repetitions It is useless for a father to tell his sons that he has been all through the list of indulgences in the shape of dances, horse-racing and the circus, and seen the folly of them—the boys want to see the folly of them for themselves. No mother ever prevented a daughter from marrying by pointing out her own cares and responsibilities.

But it seems as if railroad men ought to be willing to show up some of their mistakes, just to keep others out of the same pit, and for the general information of the craft We recently visited a shop in company with a man who for long years was a M M, the general foreman showed us a device he had half completed for turning up crank-pins. When we got out on the street again the old M M. said, "That pin turner won't work, I was all through that ten years ago"; then he gave a very good reason why it failed, and showed where the design was at fault.

When asked why he didn't put the foreman "on," he said, that he learned by experience, and that the foreman might do the same, and that he could just see where he would stop, subsequent inquiry proved that he was right. It would seem as though a little knowledge of his failure would have saved one man a lot of work, and one road a lot of expense, and, perhaps, a dozen others.

We can only find out whether or not a device or a process will work by trying it, and we find out whether they will not work in the same way When a man gets up a thing that works we hear about it and use his idea, and usually pay him for it, but when he gets up a thing that won't work he keeps mighty still, and hunts for some fellow who is working on the same line, then, looking wise, he explains to his friends where the man is "off," thus keeping up his reputation for being a smart mechanic. One of the greatest of American inventors said that his greatest achievement was the magnificent return from twenty one failures. Railroad men are too much afraid to tell about their failures.

The committee appointed last year by the American Railway Master Mechanics Association on the examination of engineers and firemen, consisting of W H Thomas, superintendent M P. of the E. T V & G.; John Player, of the Santa Fe; F. D. Casanove, of the P., Ft W. & C.; J. W Luttrell, of the N N. & Miss. Valley; and L. R Pomeroy, of the N. Y. Suburban Rapid Transit, did us the honor of recommending to the association our plan for progressive examinations, the report being received by the association without discussion or a dissenting voice. This is, to us, no ordinary honor, and one of which we feel very proud—it's a mighty poor specimen that can't feel proud once in a great while.

Two years ago, when the Webb compound locomotive came here from England, this paper made a wood engraving of her, the first one shown on this side of the water, the cut has since been used by several papers, giving THE LOCOMOTIVE ENGINEER credit for it. Last month the *Journal of Railway Appliances* borrowed the engraving, cut off the imprint on it, and rehashed something about the engine, without telling where they borrowed the engraving The "*Appliances*" seems to be just about as far behind the times in journalistic courtesy as they were in the illustration of this engine.

Book Review.

CALKINS' STEAM ENGINE INDICATOR E & F. N Spon, publishers, New York. Price, $1.50

This work is a very neat and complete one of more than a hundred pages, originally issued by the makers of the Calkins indicator and other instruments as a trade catalogue It is an advertisement and direction for use of their goods only, and as such is a very creditable piece of work, but it is not such a work as we can recommend our readers to purchase for information on the general subject of steam engine indicating, and it is altogether likely that the people who originally issued it would be glad to furnish it free to those who use, or are thinking of using their instruments.

ASKED & ANSWERED.

(41) H. W C, Newcastle, asks:

If a boiler 42 inches in diameter, ¼-inch plate, will stand 100 pounds pressure, what pressure will a boiler 60 inches in diameter, ⅜-inch plate stand? *A.*—84.33 pounds per square inch

(42) C. W H, New Brunswick, asks:

With a broken wheel or tire, what is the best way and easiest to get wheel raised off the rail to put block under box or axle? *A.* Run the wheel up on wedges, block under the box, and repeat until load is relieved. Jacks are sure, but slow

(43) H. W C., Newcastle, N. B, asks:

Is the pressure in auxiliary reservoir and main reservoir, and train pipe, equal when the automatic brake is not applied? *A.*—If engineer's valve is at "full release," yes, if in "running position," there will be about twenty pounds more pressure in main drum than in train pipe and auxiliaries.

(44) J E H, National City, Cal, asks

Please explain as clearly as possible how the point of suspension of the link, length of hangers, and position of lifting shaft affects the distribution of steam in the cylinders. *A.*—Read Elementary Lessons in First Principles, in October, November and December, 1889, issues. The subject is too long for this column.

(45) G. E R, Westown, Pa., asks:

Does the pressure on the crank-pin of a locomotive have the same leverage to move the engine when the crank is on the upper side of wheel as on the lower? The fulcrum appears to change from the axle to the top of rail, and it appears to have more power when the crank is moving toward the cylinder? *A.*—There is no difference in the leverage when pin is above or below the axle, and the fulcrum does not change

(46) J. H. C., Jersey City, writes

Will you please answer the following questions, to settle a dispute between several locomotive enginemen on the New York division, P R R., and oblige: 1. At what point in a locomotive boiler can be found the greatest pressure? Some say the steam dome is under the greatest strain; others say not I claim that if two pressure gauges be placed, one at top of dome, the other at leg of fire-box, the lower one will show the greatest pressure, owing to the height of water *A.*—At the bottom, on account of weight of water. 2 Why are check valves placed below the water line? *A.*—Because it is generally considered best to feed below the water line Some locomotives are fed above 3. Will an injector work with compressed air in place of steam? *A.*—No.

(47) M. C. G., Durham, N. C., writes:

To settle an argument between some brother engineers and myself, please say if a locomotive's drive wheels slip in rounding a curve. And if they do slip, please explain how, and oblige. *A.*—The outside rail on a curve is longer than the inside one, and in going around it, one of the wheels in a pair must slip on one rail or the other unless the face of the wheels are coned enough to compensate for the difference in length of rail.

(48) Helpless, Charleston, S. C., asks:

1. What is a locomotive? *A.*—Anything capable of moving from place to place, but now universally considered as a wheeled machine, driven by a boiler and one or more steam engines. Look in your dictionary. 2. What is lead given a locomotive for? *A.*—To fill the ports early and reduce the shock of the engine in passing the centers. 3. What is the wheel base of a locomotive? *A.*—The distance from the front to rear wheel on locomotive is the *total* wheel base, and that from the forward to rear driving wheel the *rigid wheel base*. 4. What is the wheel center? *A.*—As usually spoken of, it means the diameter of driving wheel center—not counting the tire.

(49) Reading Fireman, Philadelphia, writes:

Am on a saddle tank switcher, equipped with the latest improved Sellers injectors. The one on the right side will prime all right, but won't throw water into the boiler with steam above 115 pounds per square inch. The left one will throw water with steam at any pressure. What is the matter with the right injector, and what should we do if the left one played out? *A.*—To all appearances the cause of non-work in the right instrument is that it does not get water enough to condense the high-pressure steam; perhaps the strainer or some part of the supply pipe is partially stopped up. The only thing to do in case your left instrument plays out before you get the right one repaired, is to reduce the pressure, as quickly as possible, to a point where the right-hand instrument will go to work, change injectors, and if the right one will work on the left side look to the connections for the trouble; if it acts the same there something is wrong in the instrument, which should be repaired.

Official Changes on the Chicago, Rock Island & Pacific.

Mr. Geo. F. Wilson, heretofore General Master Mechanic, has been appointed Superintendent of Motive Power and Equipment, the position of Master Car Builder having been abolished after the death of Mr. Verbryck.

Mr. H. Monkhouse, heretofore Assistant General Master Mechanic and Assistant General Master Car Builder of the C., R. I. & P., has been appointed Assistant Superintendent of Motive Power and Equipment, with headquarters at Horton, Kansas.

Mr. John Black, Jr., heretofore General Foreman of Machinery, at Chicago shops, has been appointed Division Master Mechanic, in charge of the Illinois Division, with headquarters at Chicago.

It has now become customary for trainmen to apply the air-brakes to test them by opening the train pipe cock at the rear of the train; if they release on doing it, their being coupled up clear back is proven. In some places a hose coupling, with a pipe bent into the shape of a hook, and terminating in a cock, is coupled to rear end of train, and the hook hung over hand rail; this allows switchman who rides the rear end to stop the train just where he wants it. At the Union Depot in Denver the men have added to the pipe a small whistle with a separate cock to blow it; this uses so little air that it will not set the brake by too heavy a reduction of the train pipe pressure, and is very useful in giving signals to the enginemen, and to warn persons who may get in the way of the backing train.

Master Mechanic B. Haskell, of the Rocky Mountain Division of the Northern Pacific road, uses the surface blow off cock to clean out ash-pans. Their ten-wheelers are very hard to get under, and the firemen appreciate the "steam ash hoe." He pipes from the cock down to a cross-pipe, fastened to the frame across the front of the ash-pan. This cross-piece has several flattened nipples that point back on a level with the bottom of the pan. A small amount of water will clean out the pan, either running or standing, and insures the death of all live coals.

The Baldwin Locomotive Works are building some pushers for the Erie that will have the distinction of being the largest on earth. They will be decapods with cylinders 24x28 and a boiler 76" in diameter at the smallest ring.

Caught a Tartar.

Cyrus Warman, the energetic, poetic and phonetic editor of the *Western Railway* at Denver, which is in the State of Colorado, has got himself into bad form with some people for advancing the democratic and heretical doctrine that kings, demigods, queen bees, be-tumble bugs and professional labor-trouble quacks are not born to rule by the grace of God, etc., etc.

Cyrus rose up, and buckling on his steel pen and his trusty nerve, he attacked some ex-railroaders who always represent some of the labor orders on committees to adjust grief before railroad officials. Cyrus even went so far as to give names and dates, etc., etc., he called upon officials to meet committees of their employes who actually shoveled coal, boiled water or handled air on the road, and to refuse to do business with princes of jawsmithery who were assuming to furnish brains for the poor, ignorant car hands.

The jawsmiths took up the case of heresy, and condemned Cyrus to be hanged eleven days on a gibbet of outraged labor three hundred and nine feet high, to be drawn, quartered and fed to the dogs in the dirtiest alley in poverty flats. They proceeded to have him read out of a labor order in which he had long been a staunch, knotty old post, with the bark on. This was only the starter to carry out the dire sentence of the dread tribunal, but it appears that the hereinbefore mentioned tribunal had not asked one all-important question in a case of this kind, viz., "What will he be doing, all this time?" Cyrus had dipped his pen in gall, now he changed its bath to vitriol, brimstone, sulphuric acid and *truth*—ah, *truth*, that's the stuff that makes 'em squirm.

He proved all the charges he had made, and made harder ones; he justified his position, won the friendship of the best class of railroad men, showed his own loyalty to real, honest labor, and demanded reinstatement in his old order.

Cy. Warman was right, he attacked a form of abuse that is making half our necessary committees useless, and an expense upon labor, and bringing the orders of laboring men into disrepute. Being right, Cy. will come out of the fight with all his prerogatives restored, his honesty of purpose unimpeached, and the labor armor of the jawsmiths whom he attacked so full of stab holes that they won't hold cord wood.

Brothers, when you send a committee up to see the "old man," pick out the best men on the whole road, men who have good records of service to the company, and whom you are sure the officers respect and will listen to; don't pick out men noted for talk or bluster, and whom you know are obnoxious to the officials, who, by their very manner, will offend most men and put them on the defensive. Send gentlemen to meet gentlemen, and business men to do business, send them to *argue* your case, make offers, open negotiation, and make contracts as any other business men do, not to bluff and bluster, and threat and browbeat to secure that which reason could obtain. The best engineers and firemen on the road are none too good to meet the officers of the road in a test of argument.

There is a crisis in the Supreme Council of the federated railway employes. There is a fight between the switchmen and trainmen on the C. & N. W., the trainmen having filled the places of some 400 switchmen discharged at one swoop. The result will probably be that a new law will be adopted, making the majority rule. Now one can block the wheels of the combined orders. If the trainmen's order follow up the work commenced on the Northwestern, of course they will have to get out of the council, and we will have, for the first time in our history, an organization of scabs—any other word fails to describe the Northwestern fellows who made an agreement with the officers of the company that they would fill the places of the switchmen if they were discharged. The switchmen caused the trouble by striking prematurely in the first place, but this does not excuse the trainmen—two wrongs never made a right.

W. A. Stone has been appointed M. M. of the Alabama division of the E. T., V. & G. C. L. Petrikin has resigned, to go into other business.

Some Notes of the Southern Pacific and Central Pacific Shops.

When one speaks of the Central Pacific, the Southern Pacific, or almost any road in California, he speaks of something that was. All these roads exist, but they are not doing business in their own names—everything is owned or controlled by the Southern Pacific Company.

This great corporation was organized in 1885. It had unlimited capital, and inside of two years had control of the Central Pacific road, 1,354.64 miles; the little Sacramento & Placerville, 5.64 miles, and all the Sacramento River steamers, the California Pacific had 115.44 miles; the Northern Railway, 300.48; the Oregon & California, 474.80, the South Pacific Coast Narrow Gauge, 104 miles, and the Southern Pacific Railroad and branches that had 1,799.81 miles of track. All of this they combined and called it their Pacific System, in all 4,244.81 miles of track.

Then they got control of the Galveston, Harrisburg & San Antonio's 936.90 miles, the Texas & New Orleans' 207.73, the Louisiana Western's 112.03, Morgan's Louisiana & Texas' 283.50, the Gulf, Western Texas & Pacific's 55 miles, and the 92 miles of track owned by the New York, Texas & Mexican. This line, of 1,687.16 miles, they call their Atlantic System.

There are 5,931.97 miles of track, reaching from New Orleans west through Louisiana, Texas, New Mexico and Arizona, and traversing the entire length of California, and extending north across the State of Oregon to Portland, and east from San Francisco across California, Nevada, and to the junction with the other great lines at Ogden, Utah.

This great network of tracks serve a far larger territory than any other in this country, for at New Orleans they send their freights to New York by their own ocean steamers, and at San Francisco their boats run north to Alaska.

ISOLATED.

The Central Pacific road was commenced early in the 60's, and built by the assistance of the United States government. It was for a long time isolated from other roads, and was made to depend upon the resources of the Pacific coast for its supplies. It was then, and is now, a long and expensive haul from the East to California.

For this reason the main shops of the old C. P., at Sacramento, are different from almost anything else in the country. It is more in the nature of a manufacturing plant than are most railroad shops.

SHOPS.

The shops are large, rather old-fashioned, and comprise, beside the usual machine, car, blacksmith and other shops, a very large foundry and an extensive rolling-mill.

They do not roll their own rails, but do make their fish plates, track bolts and all other forms of wrought iron. They cut their own nails, make their own spikes, mold their own car wheels, and have built most of their own cars and locomotives. On all wrought iron they save from one to two cents per pound over eastern goods delivered. It costs $1,000 freight to bring a locomotive from the East to the Pacific coast, so that they have that much the advantage in building their own.

There are in operation on this system locomotives of almost every build, but many of them were built in the Sacramento shops. Most of them are wood-burners.

A GENIUS.

Mr. A. J. Stevens, who was for years at the head of the motive power department of the C. P., was, without doubt, an ingenious man. On every hand are evidences of his inventive genius and originality, but by his work it is perfectly plain to a mechanic that he was not a systematic man, and one so anxious for improvement that he could never come to a standard for anything.

STEVENS' VALVE MOTION.

There are some sixty locomotives now running there with his valve motion on them in one form or another. This is a radial gear, driven from a return crank on the main pin, something like the Walschaert motion, but having two separate valves and valve stems. One of the stems is hollow, the second one going through it. This rod is packed by a small metallic packing, very hard to get at and to maintain. Most of the engines having this gear have 30-inch stroke, making a very long cylinder casting, but the steam chest is longer than the cylinder. In some cases two chests are used. The port is short and direct.

On some of these engines the cylinders are placed under the front of an extension arch, and a very long main rod employed, but as they come into the shop Mr. Small is setting the flue sheet ahead.

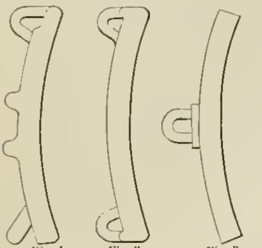


Fig. 1. *Fig. 2.* *Fig. 3.*

These engines show a slight saving of fuel over the common link-motion engines, but it costs more to keep up the gear.

CRANES.

All over the shops are hydraulic cranes of all sizes, and used for all purposes—all home made. They are very efficient, and some of them very large, especially those in the foundry

FORGE AND ROLLING-MILL.

Many of the machines in the rolling-mill were built in the shop. It is but natural that men, thrown upon their own resources, will devise ways and means to accomplish ends, and I was particularly interested in some of the inventions of Mr. Stephen Uren, who has charge of the rolling and forging work.

WROUGHT BRAKE SHOES.

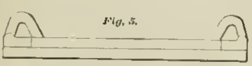
The road uses wrought-iron brake shoes of one or the other of the three forms shown in Figs 1, 2 and 3, generally 1 or 2, and they forge up these shoes from punched or sheared pieces at one blow of the hammer.

The blanks are built up, as shown in Figs 4, 5 and 6, of pieces. The loops are bent and cut off from the bar cold, and for the other pieces a cheap grade of iron is rolled the exact size, and sheared up to proper lengths by the cheapest labor

Figs 7, 8 and 9 show the way it is piled up. These completed piles are placed upon a "peel," a flat, shovel like instrument, and by it placed in a large furnace; there is a guide piece across the peel, and a rod running back to the handle that enables

Fig. 4.

Fig. 5.



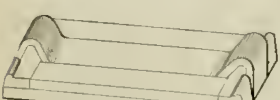


Fig. 6.

the operator to push the pile of iron off without disturbing the relative position of the pieces.

When a welding heat is obtained, the blank is picked up and placed on the lower die of a steam hammer that is properly formed, and one blow welds the pieces together, curves the shoe, and leaves the loops for the hanger bolts intact.

In Sketch 10 is shown a gauge, against which the hot blank is placed. This gauge is knocked out of the way by the upper head, but the spring automatically returns it to place when the head is raised. These heads, or dies, are easily made of cast-iron, and are held on the anvil and hammer-head by the usual dovetail. The advantage of wrought shoes made in this way, is that, after the face is worn away, a new piece of flat bar can be sheared off, placed on the old, worn shoe, heated and welded up again in this die, the loops and lugs on the back remaining intact. Wrought shoes wear several times as long as cast ones, and can be made cheaper for service rendered. Mr. Small has recently conducted some experiments, however, that led him to believe that they are not as good for steel tired wheels as are cast-iron shoes. Steel-tired wheels are expensive things to wear out.

LINK FORGING.

Another ingenious hammer die is his device for forging links. This device has been in use here for some years, but there is a dearth of information of hammer work, and "how and why" explanations are always interesting.

Links are cut from the bar, scarfed, bent and welded up by five blows of a steam hammer, using one die for all the processes. Fig. 1, page 133, is a view of the face of the upper die, and Fig. 2 of the lower one. Fig. 3 shows the right-hand end of both dies, upper one raised, and Fig 4 is a back view of the dies when closed. Fig. 5 is a view of the left end of both dies, and six is a front view.

Into the face of the lower die, and shown at *f*, is a steel knife let into a slot in the die, and on each side of this knife are oblong projections, as shown at *e*. Now, in the first step, the heated bar is pushed across this knife from *d* until it strikes

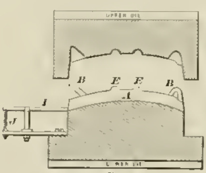


Fig. 10. *Fig. 12.*

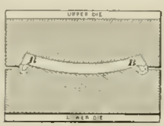


Fig. 11. *Fig. 13.*

the gauge *g*, and as the hammer descends, the knife cuts off a piece the proper length for a link, and at the same time the projections around the knife scarf the ends out. The heated piece is then picked up, and each end placed in the slot on the left end of the anvil, and against the gauge, as shown in Fig. 5. This bends the ends, leaving the piece as shown in the dotted lines in Fig 3. It is next placed across the rollers and against the gauge *m*, as shown, and the upper die descending, the lug *o*, passing between the rollers, bends the link into the shape shown in Fig. 7. It is then brought to a welding heat, and placed in the curved slot *r*, Figs. 1, 2 and 4, where it is welded up. Of course these processes are carried on in such a way that the delivery of finished links is regular.

LARGE NUTS OF SCRAP.

Very large bridge nuts are forged up from scrap boiler plate, and many other forgings can be made in the same way. This is accomplished by punching out blanks of old boiler plate, piling them up, heating, and forging them in a suitable die.

This device consists of a large die-box *A*, Fig. 1, set over a block set in a cavity in the anvil block, said block being removable, so as to discharge the forged piece through the die.

The hole in the die-box is square, and has removable cheek pieces, so that any form can be made by cutting out the cheek blocks, as shown in Figs. 2, 3 and 4. When I was there they were forging bridge nuts, $2\frac{3}{4}$ inches square, and were using a die like Fig. 2.

The large lever that handled the foundation block *D* is shown in Fig. 5.

On top of this block there is placed a bottom piece of steel, with a depression for centering the center plug *E*, Fig 7. Around this plug as many blanks—first heated white hot—are placed as desired. The hammer descends and welds the whole into a single piece. The lever swings out the foundation piece, and a tap of the hammer drives the bottom plug and finished piece out through the die. Bridge nuts, weighing as much as fourteen pounds, are forged in this way, and turned over to the store department for $3\frac{1}{2}$ cents per pound.

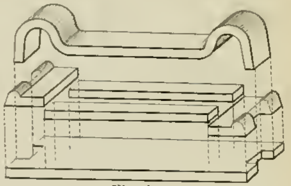


Fig. 9.

Mr. Uren's improvements on spike making and bolt heading machines are illustrated on another page.

PUNCHING.

A great deal of punching is done in this shop Most of the holes usually drilled in engine frames are punched here. Some of the heaviest punching I have ever seen done under an ordinary steam hammer was being done on some heavy equalizers, as shown in the sketch. After heating, the forging was placed in a very heavy yoke, made in two pieces, as shown, that completely enclosed the center of the lever, and prevented its expanding in any direction. In the bottom of the yoke there was a loose steel die the size of hole to be punched, and through the top binder a similar slot acted as guide for the steel punch that was driven through the work by a steam hammer. This makes a clean, clear cut, and does it very cheaply.

BIG WORK.

One hammer in this shop is turning out 40 axles per day.

The rolling mill turned out 12,000 tons of iron last year.

The foundry is a large one, but the work is done by contract.

VALUABLE EXPERIMENTS.

Out of all the diversity of equipment found here, Mr. Small is expected to find the best, adopt it and discard the poor, and to this end he is making a series of experiments that will be of great value to all other roads as well as to the S P.

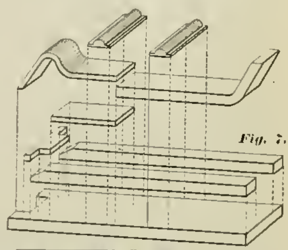


Fig. 7.

Fig. 8.

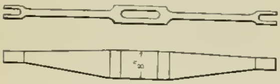
RIGID *vs.* SWING TRUCKS.

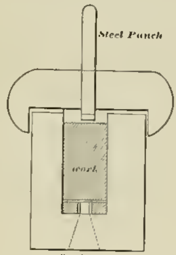
For instance, the question of the relative values of rigid or swing trucks, for freight cars, has so many advocates on each side that it is hard to come to a decision. Mr. Small took ten cars, each with rigid and swing trucks, and took them to a crooked and hilly section of the road, and experimented with them, light and loaded, under every conceivable condition, and proved by the dynamometer that rigid trucks not only curved easier, and wore their flanges least, but pulled easier than swing trucks.

He proved that the main trouble from rigid trucks come from neglect of the side bearings. Rigid trucks can be built for a third less than swing trucks. The repairs are much less, and the truck is far stronger and safer, but many railroad officers think they can't be used safely on crooked track. All their new cars will have rigid trucks.

TESTING WHEELS.

Another interesting and valuable experiment was one to find the cause of so many broken wheels caused by heating. An elaborate machine was con-





structed for this purpose, that imposed upon a pair of wheels all the conditions of actual service, and provided means for weighing the loads applied, etc. Not only all patterns of wheels made by themselves, but those made by twenty-eight manufacturers, have been tested to a failure in this machine, a careful record of load and time being kept for each. This test has been very carefully made, and extended over a long time. The result is that a form of wheel has

Fig. 1.

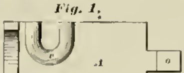
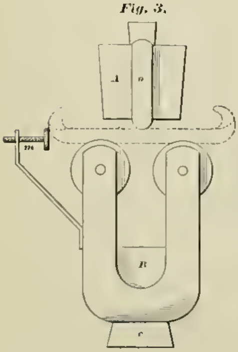


Fig. 3.



been designed and tested that has double the value of the wheels formerly used.

FUEL.

They have also made extensive fuel tests, and can tell you the relative value of all the coal used. Coal is very dear in this part of the country. They are paying $6.50 for it now, and have paid as high as $14. The Stevens motion was designed to save coal. Numerous stacks, etc., were used for the same purpose, and they are now trying a compound.

Mr. G. H. Baker, the author of a work on combustion, and formerly traveling engineer on the C., B. & Q., has recently been appointed fuel agent, and will labor with the men. We have little doubt that, if the men became interested, and got a

Fig. 2.

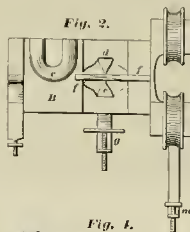


Fig. 4.

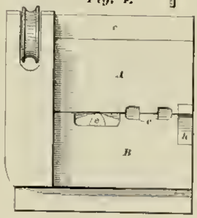


Fig. 7.

percentage of the saving, that they could make a better showing than compound locomotives or anything else. Much of the fuel here comes from Australia and from Wales. Vessels coming for wheat bring it as ballast.

EXPENSIVE COAL CHUTES.

While we are talking about coal I might as well say that the S. P. has about the worst and most expensive means of handling it. All over the road coal is put on engines by little iron cranes, mounted on four-wheeled push cars, and operated by steam, a small boiler being fast to the mast. They lift the coal in iron buckets, usually from the ground or from cars. They must have a great many of these

Fig. 5.

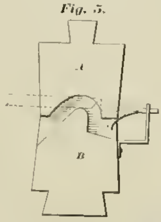
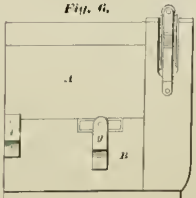


Fig. 6.



expensive little crabs, for they seem to be standard. Right at Oakland is a fair sample of coal handling. Coal is shoveled out of the ships into buckets and loaded on cars. These are hauled to Oakland yard and the coal is shoveled out upon the ground, and from there shoveled into buckets that are finally lifted upon the tenders by the little cranes.

A good coal chute at each division station would pay for itself in a very short time.

There are no new engines being built now, the works being pretty busy when they keep up the repairs. They are building 500 new box cars of 60,000 pounds capacity, and 25 narrow-gauge cars. They are breaking up a whole series of 30,000-pound cars that have reached the age for retirement, and will get rid of thirty or forty old locomotives in the same way.

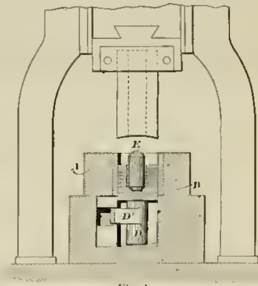


Fig. 1.

BUILDINGS.

The shop buildings are large, and in pretty good condition, but the work is more or less scattered, the offices of different departments separated, and there are several drawing-rooms in different parts of the works.

The car and paint shops are always full. One shop here is devoted to Pullman car repairs. There were thirteen sleepers in the shop, the road having over eighty in its Pacific system assignment.

Between the car shops there is a very large transfer table, operated by a chain, while a fine Norman horse pulls cars on and off it.

The table at the back shop is operated by steam, put in recently.

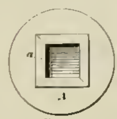


Fig. 2.

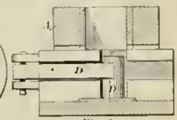


Fig. 5.

Fig. 3.

Fig. 6.

Fig. 7.

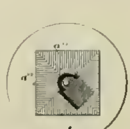


Fig. 4.

Mr. Small has made a great improvement in the appearance of the old passenger cars by extending the ends of the monitor roof to the end of the car.

AIR-BRAKE ATTACHMENT.

All engines employed on heavy grades have the Sweeney air-brake attachment, which is simply a pipe from the steam chests to the air drum, with a suitable cock in it. It is used in case the air-pump gives out, or the pressure becomes reduced from repeated recharging of the auxiliaries. By reversing the engine the pistons become air-pumps, that instantly recharge the drum. The device is cheap, requires no repairs, and is certainly an extra safeguard. I noticed that on all heavy grades, even when two locomotives were attached to the trains, that the water-brake was used. Driver-brakes are not employed, but it would seem that by their use it would be unnecessary to use the water brake.

MANY MEN OF MANY MINDS—MANY MILLS OF MANY KINDS.

The great diversity in sizes and styles of locomotives makes the details of repairs something very hard to understand. All the old lines mentioned at the beginning of this article are only leased. Each has its complement of rolling stock, and all is kept separate, and the initials of the different lines used. Most of the locomotives used in the northern country are wood burners, with the old-fashioned balloon stacks, containing about a half acre of eight to the inch netting.

GOOD ENGINES

Mr. Small has recently rebuilt a lot of 17x24 engines, putting on new boilers the same size as those sent out by builders on 18x24 engines of the same class. He has in these engines some of the best power I have seen. They always have abundance of steam, have great adhesion, and are more economical than larger engines in the same service.

In all the boilers built in these shops they flange the holes for wash out plugs out, and tap the flange. This makes a strong job, and gives about an inch of good thread for the plug

HEAVY WORK

This shop build and repair the steamer engines for the river boats, transfers and ferries some of which are very heavy They make 18-ton forgings in the hammer shop.

NEW USE FOR OLD RAIL

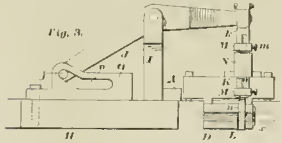
Great piles of scrap are kept on hand to be worked up in the mill, but no good use had been found for old steel rail, and there was, practically, no market for it. Mr. Small recently conceived the idea of rolling the rail head out thin, leaving the bottom intact, and using the very strong T thus formed for brake beams. To test the matter, a few beams were made by drawing out the rail head under a hammer. The beams proved, under test, far stronger than necessary, light, and very cheap A form of brake head has been made that goes on over the end of the beam, and a special forging forms the fulcrum.

They had the beam on a number of coaches when I was there, some of them having six-wheeled trucks with a shoe on each wheel, and they are certainly a neat-looking device. Mr. Small has also devised an equalizing device for six-wheel brakes, that is simpler and neater than any heretofore brought to my notice

Around and between these shops many Australian gum trees grow. In front of one of the offices there are immense palms, dates, figs and other trees, and a profusion of lilies and roses But everywhere are evidences that it is a hot old place when it is hot. J. A. H.

Some Improved Attachments for Bolt-heading and Spike Machines.

The use of pine ties in the West has created a demand for a better spike than that usually sold in the market, and many substitutes for the common spike have been devised and tried, but experiments have proven that, taking all things into consideration, the spike was the best, even in soft wood, if it could be prevented from breaking up the fiber of the wood around it The ordinary spike, with a



rolled point, will break the wood around it for an inch in all directions, while one with a ground point would scarcely break it at all.

Mr Stephen Uren, general foreman of the forge and rolling mill of the S. P. road at Sacramento, Cal., has recently perfected an attachment to a spike machine, or, more properly, a bolt-heading machine, by which he is enabled to form a knife edge on every spike in one operation with the heading process.

Fig 1 shows the outlines of an ordinary bolt or spike header. The hot bar is fed in from the front, and clamped by the side dies that hold it firmly while the ram block *H*, driven by the eccentric, forces the head into shape, and a cam roller forms the point

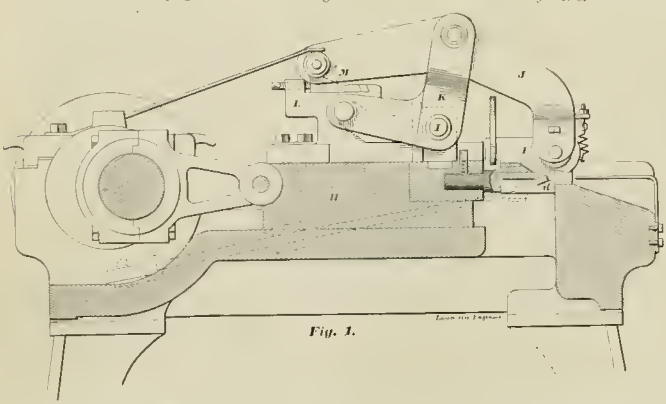


Fig. 1.

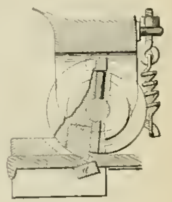


Fig. 2.

Fig. 5.

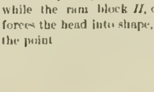


Fig. 4.

Mr. Uren's invention consists in arranging the levers as shown, the lever *J* carrying the point-forming roller. His lever is supported at the center by a bell crank *K* from a lug on the machine at *I*. On the moving die block there is fastened a cam block *L*, on top of which there is an adjustable incline block *M*, that forces down the roller upon the point of the spike. A cam slot in the block carries a roller on the end of the bell crank *K*, and an incline in this slot gives the lever a forward, rolling motion, rolling the end of the spike against the die block *d* and forming the point

Instead of allowing the roller to pass clear over the point of the spike, forcing it down to what may be termed a forged edge, the inventor provides a stop in the roller, as shown in Fig 2 This prevents the roller from turning on its work just before the steel cutter edge, on its face, reaches the point of the spike, and before the ram has reached its forward motion. The result is that the levers proceed in their journey, forcing the roller ahead past the point of the spike, and shearing the point off instead of rolling it.

The writer stood by one of these machines not long since, and saw it turning out spikes with points sharp enough to cut the fingers if handled carelessly

Another ingenious device of the same inventor is here used for punching keyways in bolts while being headed. He puts keyways into all sizes of bolts from half inch up. He uses a lever on top of the machine, much the same as in the spike machine, Fig. 3, showing the general arrangement, the bolt being held in the side clamp firmly while the head is being formed. The lever is so arranged as to punch the keyway at the same time The most ingenious part of the machine is the punch holder, shown in Fig 4 This holder is large and strong, for attachment to the standard, but will hold a very delicate punch. These are simply strips of tool steel, of the proper size, ground across the end only. They are cheap, require no forging, and a broken one can be replaced in a few seconds.

They are using one of these machines large enough to punch the keyways in draft bolts for freight couplers, and it must be saving ten times its cost every month.

Both of these devices, as well as those of the same inventor, described elsewhere in this number, have been patented by Mr. Uren and adopted by the S P road

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That awful fast run with Jay Gould on the Northwestern was lively—seventy-six miles per hour having been maintained for some time. The daily papers had the train flying at the rate of 102 miles per hour, but there's an awful gap of difference between 76 and 102

We have received from Geo. E. Ferris, of Nashua, N H., a photograph of a Boston & Maine engine, that is accused of slipping ahead when shut off, and running down hill, the same one that our correspondent Jas. Nute wrote about We will give a beaver overcoat to the man who will give us a ride on an engine that will do this trick in our presence.

John Wiley & Sons, of this city, have issued the eighteenth edition of Angus Sinclair's book on Locomotive Running and Management It is enlarged by forty-five pages of new matter, containing several plates of locomotives, spring gear, equalizer systems and truck arrangements, as well as sections of a locomotive cylinder and steam chest, etc. The price has not been increased.

How About the Enginemen?

General Meigs wants the tenders of locomotives pulling postal cars made sloping in the back end, so that in case of collision the postal car will slide up the back of the tender and escape being crushed. In an interview with a reporter General Meigs expatiated at great length on this subject. He held that the end of a tender, as at present constructed, acted like a ram on the car next to it in case of accident. We must differ from the views of this big military man, and humbly express our conviction that the present form of tender is weaker in a concussion than the ends of most postal cars, and that a sloped tender would make a wedged weapon of offense that would be much more effective in crushing through a car than the present shape.—*National Car and Locomotive Builder*

And it might be added with justice that, even if neither car or tender would be crushed, as the General apparently believes, that such a proposition shows an entire disregard for the safety of the enginemen. Possibly the General would consider it quite entertaining, when sitting in a locomotive cab, to have a postal or baggage car occasionally slide up on top of him.—*Railway Review*.

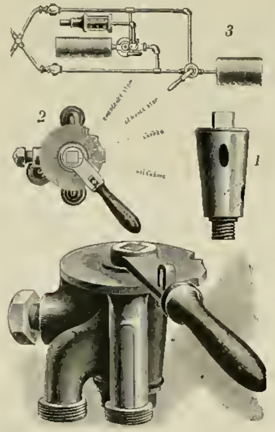
The Leeman-Jones Brake Valve.

We present on this page a cut of the latest attempt to solve the old problem—how to recharge the auxiliaries without releasing the brake.

This device was invented by C. E. Leeman, air-brake instructor, and A. W. Jones, Div. M. M. of the D. & R. G. road.

This idea of re-charging and still hold the brake on has taken a great hold of many engineers, and not a little ingenuity has been wasted to accomplish the desired results.

Every plan thus far advanced calls for a second line of hose, and an extra train pipe; this is bad enough, but we are unable to see why the recharging feature would not be dangerous with the present form of triple valves. The valve is now operated by the difference in pressure on the opposite sides of the triple's piston; when the train pipe pressure is reduced the brake is set in proportion to the reduction, and the air from the auxiliary is expanded into the cylinder, a further reduction of pressure in the train pipe will set the brake more, and we fail to see where the difference is if we



leave the train pipe pressure alone, and increase that in the auxiliary; for this will force the piston of the triple down, and apply the brakes harder—just what you don't want.

This valve is a simple one, something on the style of the Boyden valve; it is shown in the recharging position, all the other stops are the same as in the Westinghouse valve. It is a good and simple way to re-charge while the brake is on, if that is desirable—which we very much doubt.

Magnitude of Car Repair and Interchange Business in Chicago.

The business of the Chicago Belt road is, principally, transferring freight cars from one road to another in the city. Peter H. Peck, Master Mechanic of the Belt road, was present at a discussion of the interchange rules before the Western Railway Club in Chicago in April, and gave the following interesting figures

"Knowing that the interchange rules and the interchange of cars were to be discussed to-day, I have taken the pains to ascertain some facts as to the extent of interchange of cars at Chicago, and I have some figures that will be of interest to the club members, especially to the heads of the car departments.

First, I addressed letters to all the general freight agents in the city (21 roads), asking the number of cars brought into the city by their lines during the month of November, 1890. Also the number transferred to other lines. I have received enough replies to make a fair estimate. I find there were delivered into the city 261,811 cars during that month, a daily average of 10,069 cars. There were transferred to other lines 146,212 cars, or a daily average of 5,623 cars.

Averaging the length of the cars, from end to end of drawbar, at 32 feet per car, the daily average brought into the city is a fraction over 61 miles of cars. There were over 34 miles of cars transferred during the same time. Calculating the day at 24 hours long, there were 419 cars brought into the city and 234 transferred during every hour of the day.

I have also addressed letters to the heads of car departments or those having charge of the departments in the city, asking them for the number of car inspectors and car repairers employed on freight cars. I have replies from all of those addressed, which showed that there were 256 inspectors, 1,463 car repairers, and 27,970 cars repaired during November, 1890. Deducting the Belt, C. & C. Terminal and stock yard inspectors, we have left 210 men to inspect daily 10,069 cars, or about one man to 48 cars. Estimating the pay of the men at $50 per month, the cost is shown to be four cents per car for inspection alone, which sum, I think, is too much.

The daily average of cars repaired is 1,076, or 107 per hour, or 1¾ cars in every minute.

I asked for the number of drawbars broken, but most of the roads did not keep this record in 1890.

[*Continued on page 136.*]

The Belt broke one drawbar to every 278 cars handled (though this year, so far, we are breaking less), but taking that as a basis for calculating this, there are 36½ drawbars broken daily in our interchange.

The above figures do not include the repairs of cars actually broken in the city, as many of the car shops are located elsewhere.

In the same month, November, 1890, over 50 per cent. of the cars transferred by the Belt road were more or less defective. I have the reports of the number of cars that the Belt road has records against. The lowest per cent. received in defective condition is 20, the highest is $82\frac{6}{10}$ per cent., and if M. C. B. cards had been given for all defects in the month of November there would have been 2,888 cards issued daily. I think it would have been impossible to issue this number, especially under the present system of inspection. Cars would be detained too long, and we would have extra switching and double inspection. This work could be done, however, under a system of joint inspection, controlled by one chief located in the city, the same as the car service association is worked at present. There would be some trouble and attention from the heads of car departments to get such an inspection system into shape, but I think it is well worthy of a trial at least."

Charles L. Haskins, an engineer on the Jacksonville, Tampa & Key West, called at this office last month. Charlie and ye editor railroaded together in the Rockies some years back, and while there Haskins had the worst fall a man ever had and live. He was running a mixed train on the Silver Cliff branch of the D. & R. G. with a narrow gauge consolidation engine; the track was very crooked, and the grade in the neighborhood of two hundred feet per mile. In rounding one point of rocks above Grape Creek the road bed was supported on a wall of rocks laid up almost perpendicular for 66 feet, and resting on a step in steep rock at that. This wall gave way, and the engine and tender fell out from the cliff, turned over in mid-air and struck on solid rocks 94 feet below. Haskins was found 104 feet from the track, he was injured principally about the head, and was unconscious. In the half-filled coal space of the tender stood Charles Davenport, the fireman; he was buried in the fine coal as the tank struck bottom up, and left there, the tank breaking loose from the engine and rolling over and over into the creek—some eighty feet further down the precipice than the engine. Davenport was seriously bruised, and suffered for some time from an injury to his back, but is now running on the road. Haskins was unconscious for twelve days, when he did come to himself his wounds had all healed, and he knew less about the wreck than most of the men on the road. The axles of these engines are five inches in diameter and less than thirty inches between the wheels; but this one bent some of her axles badly, and was hauled in on a flat car. Haskins runs on a road now where there isn't a stone along the right of way big enough to throw at a bird—he's been to all the rock he wants.

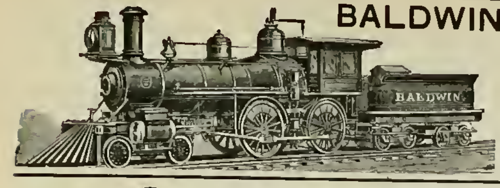
John Shanley, engineer on the D. & R. G., took a new 20x24 "hog" two years ago, one of a lot of thirty, and has since run her more than 100,000 miles without general repairs. All the others have been overhauled, but John's mill appears to be good for 30,000 or 40,000 miles yet, the tire being in fair shape. The total cost for repairs to this engine for this service has been a trifle over $500. The officers of the road have agreed to make Shanley a present for this service—a cool hundred dollar bill would be about the proper thing. There isn't a road in the country that would not be glad to sign an agreement with its engineers to give each one twice that amount for the same service.

"Some of the Functions of a Locomotive" is the title of a little pamphlet recently issued by H. A. Luttgens, assistant superintendent of the Rogers Locomotive Works. It is interesting, but especially devoted to advertising his patent stack damper—a very good device. Mailed free on request.

On the Canadian Pacific a train recently ran from Vancouver to Montreal in 92½ hours, including three hours' detention from a mud slide. From Smith's Falls to Montreal, 128.3 miles, the running time was 2h. 5m., or at the rate of 61.6 miles per hour.—*Ex.*

From some of the discussion on steel axles one would be led to believe that some roads were using crucible steel, they have so many snap off short at the hub. Probably square shoulders has something to do with the trouble.

On the Madras Railroad, in India, they shake the grates by means of gearing, and a cam wheel on the rear axle; this shaker can be brought into use by depressing a capped rod in the foot-plate.



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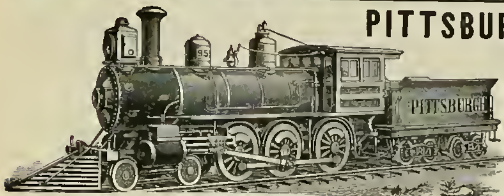

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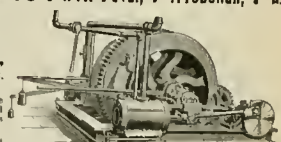

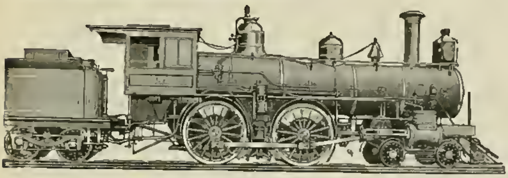

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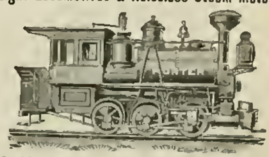

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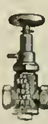

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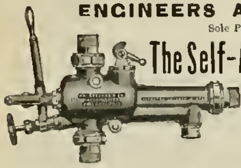

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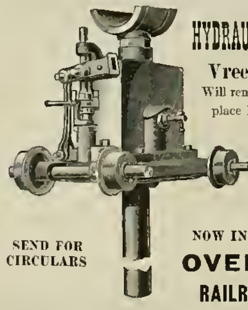

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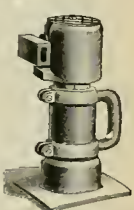

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THE LOCOMOTIVE ENGINEER.

DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
AND TO
LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 8. NEW YORK, AUGUST, 1891. $1.00 per Year or 10c. a copy.

Bouncing a Deadhead.

"Speakin' of train robbers," said the old-timer, leisurely crossing his lean shanks, "I never had to do with real, live robbers, but when we were buildin' the U. P., I seen more Injuns than a few.

"I jimmed a shifter around the yard at Omaha when I first struck the country, and used to hear the boys tell about the redskins ditching trains, stealing telegraph wire, and 'casionally shooting at an engin', to say nothin' of riding around free, and being mighty over-pompious to everybody.

"But as long as I wer'n't in the immedgat' Injun belt, I didn't worry much.

"One day I got a new Roger, and started for the front—then all the Injun stories I ever heerd come back, multiplied four hundred per cent

"All day I was on the lookout for red and green blankets; every bush looked like it might have a Crow or a Wyandotte behind it, but the sun went down without a sign of reds.

"Well, I had a train of material for the front, and would jest about get there for breakfast, if I bustled—so I hustled.

"About eleven o'clock I stopped at a little temporary water tank to liquidate and lubricate, feelin' rather sleepy for my long hours. While the fire boy was taking water I did the grease act, going around to the left side.

"As I climbed up in the gangway, and sucked in my breath to blow out the torch, my heart hit the roof of my mouth, for there, in the right gangway, stood a big, fat, greasy Injun; he had on a yellow blanket, carried a rifle, and greeted me with a grunt.

"'Wher' goin'?' sais I, gruff like.

"'Um Yum,' sais he.

"'Git off,' sais I.

"'No git,' sais he.

"Here my visitor made a move to get up on the fireman's seat, and, I don't know what popped it into my head, but I took the long oiler by the snoot, and made a lick at the gauge glass that was then almost in his face.

"Afore you could say Gee-whiz, that cab was full of steam, hot water and muffled whoops, I pulled out the plug to let the old girl make her escape, and about the second turn of her drivers I heard a heavy body hit the sod on my side with a thud, and a sound floated up to us that reminded me of a scar't hog—kinder' like 'Wough!'

"Bill and I lay low in the tank for fear of being shot, until we were outside of the range of a Krupp cannon. I often wonder now which was scar't the worst, me or the Injun."

On the Santa Fe they are having the best of results from using a cast-iron ring in place of brass for ball joints of steam pipes.

Letter ballots are out for the adoption or rejection of the standards agreed upon at the last convention of the Master Car Builders.

HISTORICAL LOCOMOTIVES.

Development of the American Eight-wheeler.

The American eight-wheeler is so well known a form of locomotive as to need little explanation, but few of our readers know just how that magnificent machine was evolved from the general chaos of styles, and went at once to the front as the best form of locomotive for our conditions.

Up to the year 1836, all the engines built in this country either had all the wheels under them connected, or had a truck of one, two or three pair of wheels in front, with a single pair of drivers, the general difference being in the location of this pair of driving wheels. Baldwin placed them behind the fire box, while Norris placed them ahead.

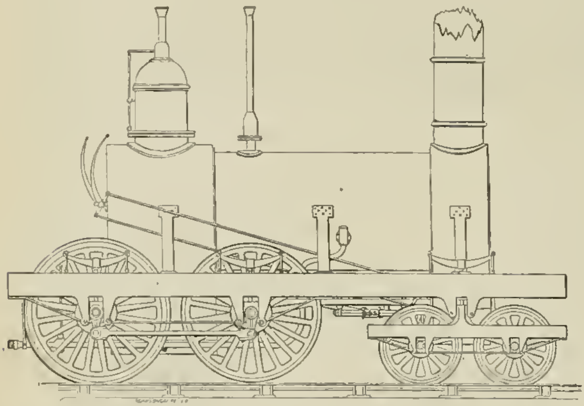
The swiveling truck early became a favorite, but the greatest trouble was to distribute the weight of the engine on the very light rails of the day, and where more than one pair of wheels were used to maintain the machinery, racked as it was by

Historical Locomotive Mercury

being rigid; this kept the single connected engines popular.

In 1836 Henry R Campbell, of Philadelphia, patented the 8-wheeler, "in order to better distribute the weight"; he built an engine after his patent, and tried it on the old Philadelphia & Germantown Road; it did fairly well, but was very rigid and hard riding.

Late in 1836, the firm of Garrett & Eastwick, of Philadelphia, built an 8-wheeler, called the "Hercules," for the Beaver Meadow Road (now the Lehigh Valley) in which an attempt was made to make the engine more flexible. Mr. Eastwick devised a separate frame with pedestals, in which the



THE FIRST EIGHT-WHEELER.

two pair of wheels were placed; this frame vibrated upon a center bearing, and could move as a truck does, except that it could not turn. This allowed it to adjust itself to uneven track, provided the unevenness was alike on both sides, otherwise it racked the framing; this frame was underneath, and separated from the main frame by side bearing springs. This was better than the old rigid plan of Campbell's, but not very much. This engine "Hercules" was the first one to have bolted straps and half-boxes on the side rods, instead of a gib and key; the rods had no keys.

This engine weighed fifteen tons, and was to run on a crooked road having strap rails only five-eighth of an inch thick, and two and a half inches wide; they were laid on stringers with "mud-sills" or ties underneath.

This engine was so flexible that she could accomplish more work than the others in use, and more like her were ordered. But in the meantime, the firm took in as a partner a young mechanic, Joseph Harrison, Jr., who set about simplifying the flexible engine, and the result was the invention of the modern equalizer, now universally used in this country and most foreign countries.

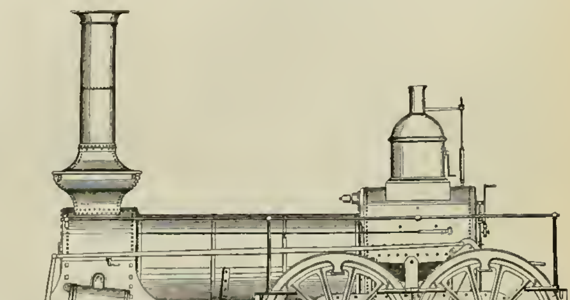
Harrison's first equalizers were made of cast-iron, very heavy and clumsy, and were hung above the frame just as they are now in 8-wheelers, the ends bearing on round pins that went down and rested on top of the box; this can be seen very plainly in our illustration on the first page. Mr. Harrison's patent covered all the combinations of equalizers now known, and also provided one for the truck. This device made it possible to use any number of driving wheels on the roughest track, and was, up to that time, the most useful improvement made in the engines of Stephenson.

The other builders condemned the use of more than one pair of driving wheels, and did not credit the equalizer with any virtue for some time. M. W. Baldwin said he could not see how they would curve without slipping some of the drivers, and he thought it impossible to maintain four wheels all exactly the same size, and thought them complicated, but their good points were forced upon him by their service, and in 1845 he bought the patent on the 8-wheeler of Mr Campbell, and that of the equalizer of Eastwick & Harrison, and at once turned out his first-class "C," and afterward said she was the best engine he had then turned out.

In 1839, Eastwick & Harrison got an order from the Reading Road for a then "big engine"; she was to weigh all of *eleven* tons, not less than *nine* tons to be on four drivers, and must burn anthracite coal in a horizontal boiler. This engine, when built and in service, made the fortunes of her builders.

In order to properly distribute the weight, the rear axle was placed *under* the fire-box, just as they are now in mogul and consolidation engines; the boiler was a "dome" or "Bury" boiler, and the fire-box was five feet long—at that time something gigantic. Two-inch tubes were used, placed close together, and nearly filling the cylindrical part of the boiler, but were only five feet long.

The cylinders were 12½x18. There was no cut-off used. The wheels were 42 inches in diameter. The exhaust was a box filled with numerous small jets, known as the Gurney exhaust, and the com-



EIGHT-WHEELER BUILT IN RUSSIA.

mon blower was here used for the first time. When finished, this engine was named the "Gowan & Marx," after a London firm of bankers.

This engine interested the whole railroad world by her great tractive power. On her trial, Feb 20, 1840, she drew from Reading to Philadelphia one hundred and four, four-wheeled cars of coal at the rate of 9.82 miles per hour—the road had a falling gradient of nearly four feet per mile, 27 miles of dead level, 9 miles of it in one place, and only one ascending grade of 26.4 feet per mile for 2,100 feet. This train weighed 423 tons, and, including weight of the tender, equaled *forty times* the weight of the engine. That was the best ever done then, and is pretty hard to beat now.

This remarkable work attracted no little attention at home and abroad, and among others who came to see and be convinced, were two colonels sent out by the Emperor of Russia to report on the best machinery and appliances for a road then projected between St. Petersburg and Moscow—the first in the empire. These officers reported in favor of engines built upon the general plan of the "Gowan & Marx," and in due course of time the Emperor Nicholas asked Eastwick & Harrison to visit St. Petersburg, with a view to contracting extensively for his government.

In 1843 Mr Harrison went to Russia, and formed the firm of Harrison, Winans & Eastwick, taking into the firm Mr. Thos. Winans, of Baltimore, and entered into a contract for building 162 locomotives and iron trucks for 2,500 freight cars.

In 1844 they closed their place in Philadelphia, taking their tools and instruments to Russia, and established the Alexandroffsky Head Mechanical Works, where they completed their fat contracts.

When the first engine was being built, Mr. Harrison designed and built a machine for accurately boring the holes for crank pins exactly at right angles to each other—this is believed to have been the first quartering machine—a rude application of the principle had been used by him in Philadelphia in 1838. This contract was finished in 1851, but a new contract was entered into for repairing the rolling stock that kept the firm busy up to 1862, when they came home to America full of honors—and shekels.

Eastwick & Harrison's 8-wheelers made their great reputation as freight engines, but before they left for Russia, or in 1842, they built for the Baltimore & Ohio two fast passenger engines, one of which, the "Mercury," is shown on the first page; in 1844 this engine ran 37,000 miles, the highest record made up to that time.

This engine had a front truck with no other side frames than the springs, to the ends of which the axle-boxes were fitted, from the top of the spring bands across the truck a heavy iron axle or shaft was so fitted as to support the front of the engine, and allow the wheels to move vertically with the least friction.

The main rod was connected to the back pair of wheels, but next the wheel center; the cylinders being set high enough for the main rod to clear the front pin. Harrison's equalizing lever is plainly shown between the wheels.

This engine had a reversible valve gear containing fewer parts than any other ever built. There was but one eccentric on a side; these were on the rear axle, and connected directly to the rocker on the back of the frame, and the valve rod ran direct to the valve, there being no way to disconnect or change it in the least. The valve worked upon a movable seat called the "reverse block", this block was connected to a stem of its own that is shown extending back under the valve stem, and is connected by the rocker shaft across the frame as shown, the lever on the deck being employed to move it.

When the motion was set to run the engine ahead, the reverse block acted simply as a false seat, the ports through it were direct, and just as they are on any engine, but when the reverse block was set to back the engine, the direct ports were moved over the valve seat end and bridges, and a new set of ports presented to the valve; in this set the ports were crooked and passed each other; the steam entering the front port was conducted to the back end of the cylinder, while that let into the port at the back of the cylinder went through the block to the front of the cylinder.

This ingenious scheme was the invention of Mr Eastwick. Its advantages were simplicity and certainty of action, but it had disadvantages, the clearance was increased the thickness of the block when in forward gear, and four or five times as much for backward gear, and it was not possible to use a valve with very much lap, any lead given the valve in forward motion caused a corresponding delay in backward motion.

The very first engine built by the firm of Garrett, Eastwick & Co., in 1835, had this reverse gear. She was built for the Beaver Meadow Road, and named the "Samuel D. Ingham," after the president, and had a roof on posts to protect the engineer and fireman—the first cab.

Thus it is seen that for the many little things that go to make up the complete modern locomotive, to Mr Joseph Harrison, Jr., or his associates, must be given the credit of several important contributions, namely. The cab, the bolted stub end rod, the equalizer and the blower, to say nothing of the equally important quartering machine.

Truly all these have done much good toward perfecting the American locomotive, and are a far better monument to the memory of Joseph Harrison, Jr., than any shaft of marble or tablet of brass ever can be.

Locomotive Running Repairs.

By L. C. HITCHCOCK.

WASHING BOILERS.

One of the most important parts of roundhouse work is the regular and thorough washing of locomotive boilers. There is no part of a locomotive which should have more care and attention, but at the same time there is no part of an engine which is so liable to be overlooked and injured as the boiler. To insure the boilers being regularly washed, some means should be taken by which a correct record can be kept of each time a boiler is washed. A very good way to do this is to give the boiler washer a book in which to put the date each boiler is washed. At the end of each week he can present his book to the roundhouse foreman, who may from it make a weekly report to the master mechanic, giving the number of each engine, and date the boiler was washed. These reports could be placed on file for reference. By referring to a book kept in this manner the boiler washer could wash each boiler after a lapse of any specified time, and if an engine came in which did not run regularly into the roundhouse where he worked, he could wash it, and keep a record of it, for boilers are more liable to be neglected than washed too often. The length of time a boiler should be allowed to run before washing depends materially upon the locality in which the engine runs. Those running in localities where the water contains but little sulphate and carbonate of lime need not be washed but about once in two weeks, but where the water used contains ingredients which produce hard scale, the boiler should not be allowed to go longer than one week without washing; and I have seen water used which produced scale so rapidly that it was very necessary to wash the boiler after each trip. To obtain the best results, hot water should be used while washing a boiler, for the reasons that hot water will more readily remove scale, and it is not so injurious to the boiler as cold water. Cold water thrown into a hot boiler produces sudden contraction, and consequent strain upon all parts. In cases where steam cannot be had for heating the water, and the time for washing is limited, a good way to proceed is to blow the steam off, and run in cold water until the boiler is completely full, then open the blow-off cock and allow the hot water to run out but little faster than the cold water is forced in; in this way the boiler can be cooled quite rapidly, and sudden contraction be avoided. After the boiler is comparatively cool, wash with not less than 100 pounds pressure. A good way to provide hot water for washing purposes is to run a permanent steam pipe through the roundhouse from the pumping or stationary boiler, if the house is heated with steam this pipe may lay in the pit with the heater pipes, but a better way is to place it at a sufficient height from the floor to clear the engine's stacks, for by this means less trouble will occur from condensation. Branch steam pipes should be put in from this main pipe to each hydrant, connect as shown by Fig. 1. Take a gas pipe tee, one end and the side opening of which is the size that the water stand pipe calls for; the other end should be the size desired for the branch steam pipe, and this pipe should be one size smaller than the main pipe from the boiler Now take a piece of pipe the size of the smaller end of the tee, and swedge down one end as represented by Fig 2; the diameter of the openings in the ends of this pipe should be in about the proportion of ⅜" to 1¼", cut thread enough on the larger end to take a check nut and elbow after it is

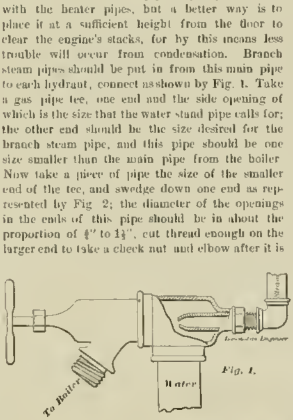


Fig. 1.

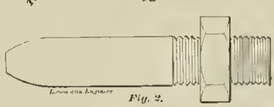


Fig. 2.

screwed through the smaller end of the tee from the inside. When in position the small end of this nozzle should be in line with the center of the water pipe, as shown in Fig. 1. Attach the tee to the hydrant pipe at the side opening, and put the hydrant cock in the opposite end from the steam nozzle. A globe valve should be put in the water pipe below the tee, by means of which the water supply can be regulated. With this arrangement good results may be obtained with from 80 pounds to 90 pounds steam pressure, and after the washing is completed the boiler can be filled with hot water, which will facilitate matters where the engine is wanted for immediate use

When washing a boiler not provided with a mud drum or hand hole in the bottom of front sheet of shell, the washout plugs should always be removed from the front flue sheet, but where the boiler is equipped with the appliances mentioned the removal of the flue sheet plugs is not so essential. All other plugs and hand hole plates should be removed each time the boiler is washed, and I consider it a good plan to remove the steam dome cap, also, for by thus doing incrustation can be loosened from the crown sheet, bars, and braces; the stream of water can be thrown directly on top of the crown sheet, this will wash the scale into the boiler legs, from whence it can be removed through the hand holes.

When the washing is completed it is a good plan to ignite a piece of greasy waste, fastened to the end of a rod of sufficient length that the burning waste can be passed through the hand holes in the corners of fire-box, and every part of the side, back, and flue sheets be examined to be sure that every particle of deposit is removed from them and the mud ring. A torch of this kind should also be passed through the plug holes in the boiler head, the top of crown sheet and space between the crown bars can thus be examined

When preparing a boiler for service, after having been washed, care should be taken to keep a bright hot fire until steam is generated, this produces rapid circulation, and scale will not form so rapidly under these circumstances as when the water is heated slowly. I have seen boilers filled with cold water, and then charged with steam from another engine by the use of a steam hose, so that the blower could be used. This is a very bad practice, for the reason that, under these circumstances, the upper part of the boiler is hot, while the lower part is cool; this produces unequal expansion, and strains the seams and stay bolts.

When a roundhouse is equipped with the appliance for heating the water as described, and the time for washing and preparing the boiler for service is limited, the blower may be worked by using a tee connection in the blower pipe where it enters the smoke arch, and making connection between this tee and the steam pipe which connects to the hydrant. The boiler being warm and full of hot water, will not be seriously injured by the use of the blower under these circumstances, for the reason that it is not subjected to the influence of heat other than that which comes from the fire-box. About the only objection which can be given to the use of the blower as described is the rapid expansion of the tubes, but the boiler and water being warm, I do not think that this rapid expansion would be productive of serious evil, and I know that it would meet the approval of some of our "hurry up" train dispatchers.

A word here in regard to the care of boilers may not be inappropriate I would say to the roundhouse foremen, be particularly watchful of the engine dispatchers, or hostlers, as they are oftentimes called. See that they move the engines as little as possible after the fires are shaken out, for each exhaust draws cold air into the fire-box, and through the tubes, causing sudden contraction and consequent injury. Never allow cold water to be injected after the fire is removed, for by injecting cold water into a hot boiler not under fire, all parts of the boiler are subjected to chilling, and the evil results attending sudden contraction are produced.

Officials are Employes, Too.

The following circular, issued by the Lake Shore & Michigan Southern Railway Co., is a move in the right direction. In accord with prevailing methods it is now in order for the saloon keepers to boycott the road, and their patrons to strike.

CLEVELAND, OHIO, June 1, 1891

To all Employes:

The attention of all employes is called to Rule 2 of rules and regulations for the government of employes, which reads as follows:

"No person will be retained in the service of this company who is known to frequent saloons or places of low resort, or who is known to make habitual use of intoxicating liquors. Every person in charge of employes is hereby directed to dismiss from the service any who are guilty of these practices; and they will, themselves, be held personally responsible for having such men in their employ; for such are certain, sooner or later, to cause injury to lives and property."

This rule is expected to be strictly lived up to; and its rigid enforcement is required. All employes are hereby warned to comply with it.

P. P. WRIGHT,
General Superintendent.

—*Ex.*

The American Steel Wheel Company, of Boston, are now making all shapes and sizes of wheels of solid steel. They have furnished some solid steel drivers to the elevated road in this city that look as neat and light as the wrought-iron wheels used on some of their engines. The Boston, Revere Beach & Lynn road are using 28" spoked wheels of solid steel for engine trucks, and many roads are using their regular pattern of webbed wheels. Mr. W G Richards, the superintendent, has devised many details in the process of manufacture of this class of steel castings that has made all the difference between partial and complete success.

Northern Pacific Shops at Tacoma.

The old shops of the N. P at Tacoma, Wash., are located right in the city, and were built of wood. The original plant was shipped there by water, as was the first locomotives, cars, and rails, and the road built east to meet the line from St. Paul.

There are only four stalls in the old shop and there are 153 engines to look after.

Master Mechanic Warner and many of his men went there by sea thirteen years ago and have remained ever since.

In the yard there can be seen extraordinarily fine timber for car building, coal that is mined within thirty miles of the town, and coke of a superior quality burned there.

Of course these shops are totaly inadequate to keep up the repairs as they should be, and work accumulates ; still this has been greatly helped by the arrival of new engines

The repair work for the road on this coast calls for extensive shops, and the company are meeting the demand by the erection, at Edison, about two miles out of the city, of the best railroad repair shops the writer has ever seen, and we believe the best and most complete in this country. A level spot in the forest has been cleared up and the shops laid out on the most liberal plan and there is not a single makeshift or temporary feature about them.

The buildings are splendid brick structures on stone foundations, and covered with steel trussed roofs, each shop is separate from its neighbor, and each has all the room in the world for extension.

Transfer tables and tracks, cranes and trolleys will take care of the handling of material. There are magnificent storehouses and storage buildings and ample yards for material

Sewers drain the entire grounds, and the plant is supplied with water by an independent station. All pipes through the shops are in tunnels, easily accessible without digging up anything

Every tool, great and small, stands on a stone foundation that goes down to rock or hard-pan.

When we were there the tools were just being set, and great pains being taken with them ; there is not an old tool in the lay out; everything is the latest and best that money can buy. Special tools are everywhere to be seen, and there seems to be plenty of them.

In designing the shops and locating the tools especial pains seem to have been made to do the work with the least handling of material. It will be a poor manager who can't make a showing with that plant.

At the old shop we noticed that equalizers, springs, wheel covers, etc., were painted brown, making a slight and rather pleasing contrast with the regulation black

On the bulletin board there was stuck up some extracts from THE LOCOMOTIVE ENGINEER, including John Alexander's advice to young runners, and everybody, from Master Mechanic Warner to the fireman of the pony, wanted to know who John was, anyway.

Cleaning Coaches by Compressed Air.

The writer thought that he had seen compressed air used for every conceivable purpose around a railroad shop until he visited the Portland, Oregon, shops of the U. P., once the Oregon Railway & Navigation Company, and here he found Master Mechanic McLaughlin using air to the best advantage in an entirely new field—that of cleaning the interior of coaches and sleepers.

The compressing plant used was regular air-pumps with large storage tanks. Air is piped to the coachyard, and there the pipes connect with a line of small hose—ordinary garden hose ; this hose is taken into the car through an open window in about the center, so as to avoid handling so much hose. All the windows are raised and the doors opened, and the car "dusted" with the nozzle. The nozzle has a stop cock in it, and the operator can regulate the stream of air to suit the circumstances.

When we visited the yard they were cleaning one of the through sleepers, from Chicago. The nozzle man was provided with a rubber mallet, made from an old car spring. With this he gently tapped the sash and blinds, at the same time directing a stream of air up into the casing around the curtain roller and inside sash.

This is a place entirely inaccessible to feather dusters or beaters, and the air does the work perfectly, as the cloud of dust blown out attests.

Letting down an upper berth, a stream of air is directed under the mattress and around the springs, cleaning them nicely.

The air reaches every nook and corner and moves the dust.

Its nicest work is shown on the plush upholstery; the stream of air penetrates the plush to the bottom, separates the nap and cleans it without brushing it down, leaving it looking like new.

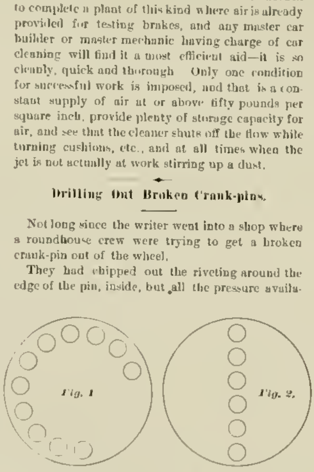
Deck sash and ventilators are easily reached, and inside blinds on coaches can hardly be cleaned in any other way.

The garden hose and nozzle is all that is needed to complete a plant of this kind where air is already provided for testing brakes, and any master car builder or master mechanic having charge of car cleaning will find it a most efficient aid—it is so cleanly, quick and thorough Only one condition for successful work is imposed, and that is a constant supply of air at or above fifty pounds per square inch, provide plenty of storage capacity for air, and see that the cleaner shuts off the flow while turning cushions, etc., and at all times when the jet is not actually at work stirring up a dust.

Drilling Out Broken Crank-pins.

Not long since the writer went into a shop where a roundhouse crew were trying to get a broken crank-pin out of the wheel.

They had chipped out the riveting around the edge of the pin, inside, but all the pressure availa-



ble failed to start the pin, and drilling was finally resorted to.

A ratchet drill was fixed up, and long hours put in drilling the pin, as shown in Fig. 1. Eleven ⅞" holes, nearly four inches deep, were drilled before the pin would start.

Had the foreman or any of his men stopped to think for a moment, they would have seen that the object of drilling is to allow the pin to shrink or become smaller, and their method of drilling all around the edge was a tedious process.

Always drill in a straight line across the pin, as shown in Fig. 2. This allows the two halves of the pin to close up, and the worst case of sticktoitiveness will have to give up to this treatment It's the logical way to go at the job, and has been used long years.

Go where you will and keep your eyes open, and you will see plenty of air-brake hose on the rear of trains hung up wrong on the dummy coupling hook. The hose head is generally hooked onto the outside hook of the dummy, and left hanging where it can swallow all the dust and dirt stirred up. The intelligent (?) passenger "gafter" does not seem to understand that the whole object of the dummy coupler is to close the end of the hose, to prevent dirt from getting into the hose and from there to the triple valves. Brakes that won't work because they are "gummed up" had never ought to surprise us—it's a wonder they work at all. It ought to be a ten-day offense to fail to protect the opening in this rear hose—unless the brakesman can prove that the coupling is so put up that it is impossible to couple the hose on. We recently asked a rear brakesman why he hung the hose as he did, and he said that he had to try the air from the rear and it saved him taking the hose down—he ought to have had a rest.

Computing Grades—The Different Ways of Expressing.

Civil engineers, in computing grades, say, so much in 100, or, such a per cent. Thus, a grade of three inches in 100 feet would be stated as "¼ in 100, or ¼ of one per cent." By the English method it would be called "one in four hundred." The American method always gives the grade per mile, which in this case would be "$13\frac{2}{10}$ feet per mile."

Where the engineer said three per cent., or three in 100, the English would say, 1 in 33⅓, which, by American practice, means $158\frac{4}{10}$ feet per mile.

To reduce grades stated in per cents or the rise in 100 feet, to feet of grade per mile, multiply by $52\frac{8}{10}$. Thus a three per cent. grade reduced to feet per mile is expressed $3 \times 52\frac{8}{10} = 158\frac{4}{10}$.

To reduce grades stated in the English method to feet per mile, divide 5,280, the feet in a mile, by the number stated, thus 1 in 25 would be expressed, $5{,}280 \div 25 = 211\frac{2}{10}$ feet per mile.

Crazy Again.

There are 30,000 locomotives in the United States, that if strung in a straight line would be 300 miles long. They cost $450,000,000 to build. The largest locomotive works is at Philadelphia, the Baldwin, and they turn out three engines a day when pushed. It takes 1,000 men a whole day to build an engine, on the average.—*Virginia Manufacturer.*

The average total wheel base of our largest locomotives with their tenders is about 58 feet; putting it at 60, and allowing that all the locomotives in this country are full length, the 30,000 would not cover 35 miles of track, and would doubtless go inside of 30 when all collected in the general round-up.

At the Master Mechanics meeting this year an associate member attempted to tell how much better a compound locomotive was than a simple engine. He is a member of the committee of science and arts of the Franklin Institute of Philadelphia, and one of the men sent out to report on the compound. He stated before the M M's that the compound went up a hill easily on the Reading road, that was so steep that it was impossible to get water into the boiler of a common engine, and when some irreverent members smiled he asked Superintendent of M. P Paxton to help him clinch his argument. Mr Paxton said the men didn't put in coal on that grade (they burn anthracite). The men probably thought the speaker was as green as grass in practical railroading, and so filled him up for fun. The idea that the mechanical heads of our American roads are called upon to sit open-mouthed and listen to such rot, strikes a man up a tree as "sorter komikal." We wonder if the cream of the Franklin Institute is represented by the committee of science and arts, and, if it is, of what use a report on a railroad subject is from men who can be induced to believe that you can't put water into a poor, common locomotive on a dizzy grade standing up on end—like a kite string—almost *thirty feet per mile*. The M Ms. ought to pass a law that associate members must know enough about practical railroad engineering so you could notice it on 'em.

July has brought her usual crop of disastrous wrecks. The excursion business is at its summer flood. More trains, more business, and green men in the train service, one or two nervous train dispatchers, and an excitable engineer, who imagines that a train of cars with windows in them calls for wild running and desperate chances, and your plan for wreck and trouble is complete. There are two reforms necessary, and necessary right now. One is something that will force brakemen to go back and flag as they ought, and the other is to force railroad companies to equip their freight trains with automatic air-brakes. Ninety per cent. of the passengers killed on our roads are killed by rear collisions, and probably ninety per cent. of these accidents could be avoided if these two safeguards were doing their duty, their whole duty and nothing but their duty.

The gauge of a road is the distance between the insides of the rail heads—not from center to center of rail, as some think.

One Sensible Judge.

"The act of God" has been one of the forms of crime against the established laws that courts could not punish for. This phrase of law has survived from medieval ages, and should be used in these times just as much as we wear breech-clouts or sandals—and no more.

At last one United States judge has been found with good sense and justice enough in him to sit down upon this worse than baby act, so often employed by our railroad lawyers to excuse gross carelessness or criminal negligence in the management.

"Not long since a train on the Virginia Midland Railroad had been derailed in a narrow cut in consequence of a landslide, which was due to a heavy fall of rain. In deciding an action for damages incurred in the accident the court remarked significantly, 'You who know so much about the law of God and the processes of nature must have foreseen that the earth hanging over that narrow, unprotected cut would be loosened by the rain and brought down upon your track by the law of gravity. Common prudence and ordinary engineering skill would have prevented such a result, and we, therefore, hold you, and not God, responsible.'"

A hundred years ago this plea would have been accepted, and any one who objected would have been called a heretic. Let us hope that it will not be another hundred years before this phrase will be unknown to our laws, and science be sufficiently advanced to provide for every purely material contingency, and reduce the business of transporting goods and passengers to an insurance.

The Difference.

From an English exchange we clip the following information on the extended use of block signaling in Great Britain:

The British Board of Trade report on interlocking and block signaling for the calendar year of 1890 has been issued. The percentage of double-track road (used for passenger traffic) that is operated on the absolute block system is 98½ in England and Wales, 100 in Scotland, and 35 in Ireland, making an average for the United Kingdom of 95 per cent. The increase from 1889 is only ½ per cent. The only roads showing a notable increase are the Manchester, Sheffield and Lincolnshire and the Manchester, South Junction and Altringham. The appendix, giving replies to the circular asking information about proposed work for 1891, which, in consequence of the recently enacted law, might be expected to be more than usually important, has very little of interest. Those roads which have the most to do to bring their practice up to the standard of the law evidently had not completed their plans when this report was made up. The Lincolnshire and Yorkshire reports that "two position blocks" have been substituted by "three position blocks" at the half dozen places named, and 16 sets of electrical apparatus to repeat the action of signal arms have been put in at various places, also 29 additional telephones in block-signaling cabins. The percentage of switches, grade crossings, etc., properly interlocked is 95 in England and Wales, 87 in Scotland, and 65 in Ireland. Ireland has increased 60 to 65, and the other countries slightly. The average for the United Kingdom is 92¼ per cent.

The average percentage of blocked track in this country is very small, indeed—certainly not five per cent. There is great need of improvement in this line.

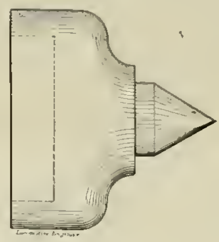
A correspondent writes that there ought to be a kick made against the practice of a reputable builder, in putting the stuffing-box for throttle stem through the boiler head from the *inside* of the sheet, with the gland stud passing through the boiler-head and having nuts on the inside end to draw the stuffing-box up to make the joint. Suppose one of these studs should break, we must take out the throttle pipe and enough crown bar stays to allow a man to get in the boiler and replace it, unless some other way of getting at it could be devised.

Last year the C., B. & Q. paid out $461,129.24 for foreign agencies and advertising.

Some Shop Kinks from the Northern Pacific.

Livingston, Mont., is a good way west of headquarters for the N. P. at St. Paul, but it has the second largest shop on the system.

Master Mechanic Angus Brown was away the day the writer devoted to his shop, but we were well taken care of by Gen'l Foreman Wm. Mallahan, Shop Foreman C. B. King and tool maker G. P. Strickland.

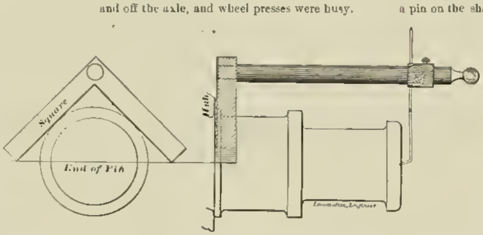


This shop is the conventional railroad shop, better than the average in having fair brick buildings, plenty of yard room and newer tools, but like them in general arrangement.

The place is kept neatly; it is not a floral conservatory, but a neat and orderly shop, where lots of hard, dirty work is done.

WHEEL WORK.

There seems to be an awful amount of car wheel work done here; the yard was full of wheels on and off the axle, and wheel presses were busy.



The writer saw a whole car load of wheels being unloaded, all but two or three pair being "slid flat." Last year, at this shop, they put on over eleven hundred new cast wheels for the Rocky Mountain district alone, mostly all "slid flat."

In making new axles, the forgings are cut off the proper length, and placed on V's between the ram and tail piece of a hydraulic wheel press, the V's being set the proper height to center the size of axle being handled.

On the ram and tail head of the press they place cast-iron blocks or caps, into which are fitted heavy hardened steel centers (see cut); one movement of the press ram forces these centers into the ends of the axle, making the center holes where wanted, and ample enough for any amount of work.

TESTING CRANK PINS.

They use here a very simple crank-pin gauge of their own make, something like the sketch shown herewith, which is from memory. The instrument is much like a surface gauge, but something heavier, the base or end is a square piece of steel formed into an angle of 45°, as shown; at the corner of this square a post is set that is at right angles to the base of the tool, and on this post are the usual sleeve and thumb nut to hold and adjust the scriber.

All crank-pin bosses are faced off, and the collar or shoulder of crank-pins next the hub receive no wear, and these two parts are taken as true points to measure from.

If the base or bottom of the square is pressed against the crank-pin boss, and the insides of the angle are brought down upon the pin collar, the post will stand perfectly parallel with the pin—if it is true—by setting the scriber to the center or to a circle drawn around the center, and the gauge be then moved around the pin, the point of the scriber will at once tell whether or no the pin is sprung. If the pin is true, the straight point of the scriber is set to the face of the bearing, and the gauge moved around the pin, to show where the greatest wear has taken place. This is an excellent tool, and one that any intelligent mechanic can easily make, and one that should be in every roundhouse outfit.

GOOD VALVE TRAM.

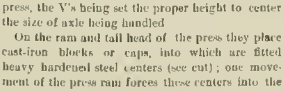
The big hogs on this road have their valve stems so close up under the running boards that it is very inconvenient to make tram marks or see them on top of the stems in valve setting, so they make a tram that will make the marks on the front of the stem; the tram has at one end the usual long point to reach the prick-punch mark on the cylinder casting back of the steam chest, and has on the other end a T, or two points, and at right angles to the point on the other end of the tram, these points make the tram a "right or left," so that one does for both sides of the engine.

FLUE HOLE CUTTER.

They make a common shank do for different sizes of flue hole cutters. The shank has a squared end for driving, the opposite end terminating in a small stem or guide to enter punch or other center holes, the shank has a collar below which the cutters are placed, and are prevented from turning by a pin on the shank that enters a right-angled slot in the cutter. The cutters are made to fit over the base of shank and up against the collar, and have four teeth or cutters about three-quarters of an inch deep; these cut on the face only, and can be sharpened by grinding on the face, which does not change the size of the hole.

TO CURE A REACH ROD WITH ST. VITUS' DANCE.

Some of the big engines on the N. P. have intermediate tumbling shafts and two reach rods, multiplying joints. Others have very long reach rods, and still others have rods with several curves in them. When length and curvature are combined, especially in big engines, the way the rod slaps and dances and jerks is appalling. Forks to prevent the rod from slapping sidewise have long been used, but it has been noticed here that most of the movement was vertical, and they have devised the plan shown in the sketch to support the center of the long rod. The usual fork is retained to prevent side motion, but below the rod, in the fork, is pivoted a roller, and the proper arc cut on lower side of reach rod to allow the roller to bear the weight of the rod in all positions it is called upon to take.



They have a good tool-room at this shop fairly stocked with good tools, including standard gauges. They have the largest sized Pedrick & Ayer miller here, but it is too big for tool making and could more than double its usefulness out in the shop.

Valve seat planers, cylinder boring machines and drilling is done by ropes from a special small shaft running across the pits in the main shop.

GOOD BLACKSMITHING.

This place is fortunate in having a foreman blacksmith who does a large variety of work with very ordinary facilities. He had just forged a long front drawhead for the pilot of a passenger engine, that would have graced the front of a fire engine, with its side hand-holds and dragon head.

Privilege has been granted to an American company, composed mostly of Boston capitalists, to construct a railroad from Carthagena, the principal port of the republic of Columbia, to the Magdalena River, together with a grant of 400,000 acres, to be selected anywhere in the country.—*Bradstreet's.*

Correspondence

Big Mileage Record.

Editor The Locomotive Engineer:

The July issue of THE LOCOMOTIVE ENGINEER gives an account of mileage made by an engine on the D. & R. G. R. R., run by Engineer John Shanley, making over 100,000 miles. There is a record here which we think will also bear publishing in THE LOCOMOTIVE ENGINEER.

Engineer H. T. Hale took Engine 56 on the Brooklyn elevated road, November 10th, 1887, which he run, without general repairs, until January 1st, 1891. This engine averaged 175 miles daily, and ran three years, one month and twenty days, and in that time did not cost the company near the amount expended on Mr. Shanley's engine. The engine was in condition for further service, but her stay bolts and flues gave out. Allowing one day a month for wash-out, the engine was in service 1,108 days, making in all 193,900 miles.

Brooklyn, N. Y. B. E. ENGINEER.

[There is a great deal of difference between running a locomotive with eight drivers and ten truck wheels, weighing, tank and all, something like 200,000 pounds, and one having four drivers and four truck wheels, weighing only 44,000 pounds. The "hog" pulls all she can, dead freight, the Brooklyn "L" engine seldom, if ever, over four cars, generally three, the "L" is up in the air, out of the dirt, the "hog" on the ground, in the sand. The record of the Brooklyn engine is good, but we find that on the N. Y. Elevated a mileage of more than 200,000 has been made repeatedly. One engine of the Second avenue ran for more than five years without being off her wheels; her mileage being nearer 300,000 than 200,000.]

Misplaced Cab Fittings and Other Abominations.

Editor The Locomotive Engineer:

I will agree with W. De Sanno that very little pains are often taken toward locating injectors, air-drums, or even gauge cocks in best places, both for the convenience of engineer, or to best serve the purposes intended. Gauge cocks are often put in back head well to side, in close proximity to reverse lever instead of closer to center of back head, where they would be less in the way, and where, when in need of grinding in, less steam would be blown in face of engineer, or in cold weather deposited on cab windows, besides a more accurate indication of the water level could be obtained. How often injectors are placed inside cab, where leaking joints, hot steam pipes, and want of room make them undesirable, to say nothing of cab windows in cold weather continually coated with moisture from overflow. Again, often when placed outside cab, injector and air pump will be so tangled up that De Sanno would surely complain about having to take them down or repair. Air drums when located on top of tender give a little trouble during cold weather. The best place for them is back of cylinder saddle, between frames when possible, or else under back end of footboard of cab on consolidation locomotives. When placed under front of engine two drums ought to be put in instead of one, so engine truck could be got at easily; besides, a cock should be put in all air-drums where it could easily be reached by engineer when necessary to drain air drum of water. We need no more contrivances on top of boiler; better to put sand-box in wheel cover, or else make it in some shape that would be low and not obstruct the view, also a better arrangement of valve, etc., for putting the sand on rail is needed.

Pittsburgh, Pa. J. J. CLAIR.

Who Invented the Balanced Throttle Valve?

Editor The Locomotive Engineer:

In your paper a few months ago you describe some English practice, and mention for one thing the flat throttle valve. Now when I was an apprentice I was told that the round double-seat throttle was an invention of Clark's, who was locomotive superintendent of the Great Northern of Scotland Railway over thirty years ago, and has been their standard since. What I would like to know is why is it called American if it is Mr. Clark's; and if it is American, I hope you will be able to tell us the inventor. The same thing has caused many debates, and no one I have met with has been able to give me information about it. Hoping, Mr. Editor, that you will give this space in your paper, and I have no doubt but some of your correspondents will enlighten us. WILLIAM PRATT.

Brainerd, Minn.

[The double-seated throttle valve has been in use in America for nearly forty years. We do not know who first used it. Perhaps some of our older readers do.]

Air-drums, Brake Failures and Pipe Connections.

Editor The Locomotive Engineer:

You seem to think that the air-drum should be the lowest point in the brake system; well, there are no objections to that, but in a great many cases the drum collects so much water from drainage that there is no room left for air.

It is possible in some accidents, when we read *the air-brakes failed*, that there was no air—it was all water—more particularly where straight air is used. If drip cups, auxiliary reservoirs and air drums are kept well drained, the danger is averted. There is the same danger in the automatic system by not having air enough to recharge with on descending grades.

There is a great deal laid to the air-brake refusing to work in emergencies that should be put on the shoulder of lazy train men, or air-brake inspectors. The air-brake is all right, and in ninety-nine times out of a hundred it will work if not handicapped by the conditions mentioned. Under the circumstances I fail to see any good reason for putting the drum under the footboard, and I think, further, that, if the man who puts it there had to monkey between the top of the drum and footboard to get the draw-bar pin out, he would vote it a nuisance.

Now a word about air drum connections, in taking down air-pipes there is great trouble in having the nipple unscrew out of the sheet, simply because the grip of the union is greater than the thread in the sheet. If the sheet is not flanged where the connection is made, a brass boss should be riveted on, to give plenty of thread for all connections. W. DE SANNO.

Corry, Pa.

[Drums that get too full of water to hold air ought to be treated for dropsy. And this is the engineer's business.]

Interesting Notes from an Engine Driver on the Government Railways of New South Wales.

Editor The Locomotive Engineer:

As an annual subscriber to your journal I undertake to offer some information on a subject referred to in your issue of April, viz. Examination of Locomotive Engineers and Firemen. I notice on page 75 that a master mechanic's committee desire information on that subject.

In New South Wales it is customary to employ youths from 14 to 21 years engine cleaning at various rates of wages from two shillings and sixpence (60c.) to seven shillings ($1 68) per day, an extra sixpence (12 cts.) per day being given for night work. They are considered to rise by biennial increases until the higher wage is reached. There is an exception to this course, however, as any fuelman, blacksmith's striker, fitter, laborer or other employe under the age of 32 years, who, having been at least two years in the service, can, when a vacancy occurs, enter as a cleaner at six shillings and sixpence ($1 60), which causes him to work at least six months in that capacity before he is entitled to promotion, and he has to undergo and pass a medical examination, and be of standard weight and height.

Men coming from, say America or India, and joining the service here with certificates of service and ability in those places, have to go through the cleaning portion before firing. When a vacancy occurs for a fireman, a cleaner is promoted who has previously been examined by an inspector as to his eyesight, knowledge of the book of rules, method of oiling, and block signal working; if he is negligent and has not posted himself up in his work, or I should say, future work, he has to stand back and allow the smarter man to go forward.

Upon being promoted he receives eight shillings ($1.92) per day of nine hours, 54 hours for a week's work; anything over that is called overtime and paid for at same rate. He receives two increases of one shilling (24c.); that is, after one year and six months he receives nine shillings ($2 16), and after a similar period 10 shillings ($2.40), and is called a first-class fireman, and after 12 months in that grade (making a total of four years' firing) he is considered fit (if capable of passing the examination) of taking charge of an engine.

He receives 11 shillings ($2.64) per day at first and a yearly rise of one shilling (24 cts.) to 14 shillings ($3 36); then serves seven years in that grade, and passes the technical examination for the highest money—15 shillings ($3 60). There is not allowed to be more than one-fourth of the total number of drivers in that grade at one time. Men very often fire for seven or nine years before promotion takes place, and rarely less than five. Where shunting (switch) engines or ballast trains are run from, the young driver or fireman has to do that work till relieved by subsequent promotions, and then go on goods and mineral trains.

It is always ascertained, upon entering the service, the knowledge you possess of reading and writing, etc. When the inspector of any district anticipates the increase of the staff of drivers, the senior firemen are called upon in rotation to present themselves at the office of the depot in which they are working, and are examined as follows: Name in full; age last birthday; length of service; present rate of pay; knowledge of rules and regulations relating to signals and the approaches to stations, whether on the up or down grade, level, etc., and the grades of the road over which you happen to have fired; block signal working and breakdowns and their remedy (the necessity of always seeing to the protection of your train being paramount in every answer); use of the eccentrics and the link motion; use of lap and lead, method of trimming those parts of engine having a rotary or oscillating motion; use and principle of injector; use and principle of lubricator (Roscoe's); principles of combustion, and method of firing different classes of engines; prevention of the omission of sparks; a complete and thorough knowledge of the Westinghouse Automatic Brake as at present in use here. Eyesight tested by inspector having a number of cards on which a number of colored circles are painted—red, yellow, green, blue, black, in various positions. There are also a lot of black dots which are just visible at the distance, about 14 feet. You have to describe the colors on each card, with the number of dots, then place one hand over the eye (say the right one) and tell the colors and dots with the other, and reverse, and occasionally the men are caught unawares and asked to tell the colors of flags that are being moved about by a man ½ or ¾ mile away.

There are several matters, especially the pump and other puzzles, that I would like to have a go at, but distance prevents. I have not always sufficient time to write a letter of any length, so do not write at all; but I may at no distant date give you a description of some of the classes of engines we have here. I consider Engineer Hood used common sense in running his engine the way he did; the result proves it. MOGUL.

New Castle, N. S. Wales, Australia.

About Examination of Firemen.

Editor The Locomotive Engineer:

The examination of firemen as they advance to the grade of engineer is all right in principle, but who is to do the examining in the locomotive department? Some of the candidates may be fortunate enough to appear before one or more of the well-chosen committee of the M. M.'s Association, but a very few of them.

Of course there are plenty of men in authority who can make these examinations, but if to hear first-class engines go limping over the road is any criterion to go by, some of those in authority had better learn something themselves.

Some men may learn to answer the questions as a parrot learns to talk; but when brought face to face with the parts of an engine they are at sea, and don't know a thing when they see it. Let me illustrate: I was working in the back shop, there was a tag with a cut of a sight-feed lubricator on it; an embryo engineer (one of the kind who are always kicking to be "set up") came along, picked up the card and asked me if it was a new kind of air-brake? Now that fellow had been using that identical lubricator right along, but when he saw a picture of it did not know what it was. John Doe can tell you what inside and outside lap is just as he has been told, but take him into the back shop where an engine is under repairs, give him a rule, show him a valve and seat, and ask for the dimensions, in five cases out of ten he cannot give them.

After a fireman has graduated as such he should put in six months roundhouse work under a good man, where he could learn how to take down rods, file brasses, and get a good insight in running repairs, and another six months working about the pits in back shop. The information gained by this course would serve him a good turn in after years, unless he was a practical mechanic to start in with. There is just this in it, the coming locomotive engineer has got to be more thorough than in times past.

Railroad companies are getting things down fine, and the boys have got to keep step.

In examining men on breakage on the road, a man may say what he would do, but when the break comes the design of his engines may force him to pursue an entirely different course, and if he is a clear, level-headed man, he will come out all right. Some engines are crippled in their designing, so far as a breakdown on the road is concerned. Take for instance that splendid engine illustrated in June issue, if she breaks a forward side pin, or strap, every side rod on her must come down; but if a rear rod, pin or strap, only the two rear sections come down.

Ask some of the young runners why and how the rods should be made to avoid taking all side rods down in case of the breakage of a forward one.

Corry, Pa. W. DE SANNO.

[Our correspondent evidently thinks the future locomotive engineer will need to know how to repair his engine as did the engineers of thirty years ago—we do not. The more they know about the way work should be done, the better, perhaps, but it is not necessary that the best locomotive runner in the world should know how to file brasses or set valves.

This fear that men will learn all about a locomotive, parrot fashion, is a fancy; no man can intelligently answer questions about breakdowns, if they are slightly varied, unless he knows something about locomotives.

Knuckle joints in side rods are the cause of disconnecting troubles spoken of, and the only cure is to make short rods reaching only from pin to pin with a brass at each end, but this costs more and is a doubtful remedy.]

Heating Air-pumps.

Editor The Locomotive Engineer:

Replying to George Holmes, of Roanoke, Va., in the June paper, on air-brakes heating and choking air passages, will say if the air valves have their proper lift, receiving valves ⅛, and discharge valves $\frac{3}{32}$ of an inch, and having perfect ground seats and good air tight rings in air cylinder, there will be no hot pipes nor corroded air passages. My theory for heating is that the pump, instead of forcing the entire quantity of air through into reservoir every stroke, as it will do when valves are perfectly seated and air is held in by discharge valve, it simply heats the air by churning it back and forth through restricted passages and through badly ground valves, burning the oil, corroding up air passages, burning packing, breaking air valves, etc. The first defect in the air cylinder is always betrayed by throwing hot air back out of the suction pipe.

I think Brother Holmes' theory as to water in air-drum and train pipes is a little wet, and needs drying, as condensation will take place whether his tobacco is wet or dry, or regardless of the condition of the weather. We all know that a warm atmosphere condenses moisture in contact with a cold surface; hence air passing through a warm cylinder into a cool pipe, thence into a colder reservoir, and kept cooling by motion of train, is the correct theory for water in reservoir and train pipes.

Mobile, Ala. D. O. SMITH.

A Cheap Hose Coupling Fitter.

Editor The Locomotive Engineer:

No doubt there are many readers of your valuable paper that have more or less experience in attaching feed, steam heat and air-hose fittings, that do not care to go to the expense of the machine for that purpose, illustrated in your July edition.

To those, I think that the accompanying sketches will furnish an idea of an inexpensive arrangement that will do the work easily, and is so simple that but little explanation is necessary. It can be used on any modern upright drill; we use it on a 24-inch Bement, the quick return lever forcing the fittings into position quite readily.

Fig. 2 illustrates the device for holding the ordinary air-hose coupling; the body is made of wood, to which a shank fitted to the drill press spindle or socket is attached with wood screws.

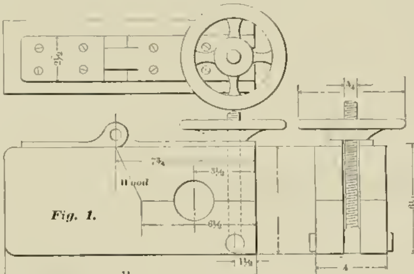


Fig. 1.

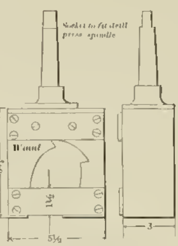


Fig. 2.

Fig. 1 illustrates the vise for holding the hose, also made of wood, with iron hinge, screw and wheel; any ordinary railroad repair shop will have plenty of these at command; if not, it is no great job to make them. the writer brought into play the following: For the hinge, a damper hinge was found to be all right, a wedge bolt was used for the screw, while a discarded spark-pot furnished the required hand-wheel.

It is operated as follows: Place the device for holding the fittings in the drill press spindle, and insert a coupling in the opening in the wood, bolt the vise firmly to the platen, having the slot for the hose just clear the edge, and also in a central position under the shank of the coupling, grip your hose firmly in the vise, allowing just the amount that the fitting will take up to extend above the vise, thoroughly grease the shank of the fitting, and it will surprise you how easy they are forced into position. The ingenuity of the average machinist will devise a way for holding all the other fittings.

This machine, with the "hose clamp holder," described in THE LOCOMOTIVE ENGINEER, Vol. II., No. XII., will make an outfit that any railroad repair shop or roundhouse can possess.

Quite an extensive machine for this same purpose was described in the *National Car and Locomotive Builder* for June, 1891, the same being used in the Topeka shops of the A. T. & S. F. In their description, they say, "and a pipe mandrel put inside (the hose) to prevent collapse," when it is gripped in the vise. This recalled a bit of experience I had when the machine described above was constructed, there was a mandrel for the same purpose that they mention, made, and possibly would be in use to-day, the same as the Topeka shop, had not the young man who had been in the habit of putting the fittings in "per force," been anxious to give the machine a trial, and did so in the absence of the writer from the room, and he knew nothing about the mandrel mentioned.

Upon my return, I found the fitting, which was to be put in a five-ply steam-heat hose, had been readily put in place without the use of the mandrel, much to my surprise. C. H. W.

Boston, Mass.

Headlight Signals.

Editor The Locomotive Engineer:

I have just been reading an article in your June paper, entitled "Darkening Headlights for Signals," and I cannot endorse the writer's views on the subject. He says, "If they are not there the place is dark; if they are there and all lights shrouded, the place is dark and everything uncertain," etc. Now here on the "Burlington" we know when we see a headlight at the station where we have a meeting point, that the opposing train is not "in to clear."

If it is in to clear, we have brakemen, whose business it is to give us signals that such is the case, even though we are unable to see the train. A common, and I think a much more satisfactory signal, is for the fireman or engineer to lift the headlight curtain twice, immediately after an opposing train has "whistled in."

If this is not possible, as in a case where a train has "headed in" on a track, and there are cars ahead, so that the headlight does not show, then, as I said before, the head brakeman will give a signal that all is right and the engineer can "let her go."

Judging from the last illustration he gives, however, one would infer that they do not have brakemen over there. He says, "It is dark and stormy, your headlight has gone out by virtue (if there is any virtue in such an occurrence) of a bird flying against the glass and breaking it. As everything is dark at the station, you take it for granted that they are on the side track, and pull through, but they got laid out and did not make it. . . You know the rest." In the first place, if your headlight glass is broken by *any* means a lantern should be fastened in it. In the second place, *you have no right to take anything for granted*, and in the third place, if you were running here and "got laid out so that you could not make" a meeting point, there would be a brakeman from your train flagging far enough ahead to stop the opposing train before a collision could occur.

McCook, Neb. T. W. BENJAMIN.

The Injector Question.

Editor The Locomotive Engineer.

To Mr. Gibson's first injector question I would say that the suction pipe was partially stopped up, or drawing air. To his second question would say that the check valve was stuck fast to seat, the combining tube was broken, there was not enough steam turned on to work the instrument, or else water was too hot to work. BEN HEAD.

Cambola, Pa.

Editor The Locomotive Engineer.

The following causes led to the trouble I experienced and spoke of last month:

First—Stuffing box nut of overflow valve was loose, allowing air to enter, preventing the formation of a vacuum. Second—A bent delivery tube will cause injector to fly off, also the combining tube not working free will cause the same, as will check valve being stuck. EDWARD GIBSON.

Wilmington, Del.

Two Waifs of the Rail—Hogskin Thompson's Mascots.

By John Alexander.

Sometime toward the close of the war there was a bright-faced boy in our Old Man's office, known then only as "Cy."; perhaps he was 12 or 14 years old, mostly all legs and freckles, as New England boys of that age are prone to be, but bright, sharp, and attentive to business; he was a boy you'd like in a minute, but he had the engine fever worse than most of 'em do, and even symptoms are bad enough.

"Cy." hounded me about getting him on to fire for two years, struck the Old Man for a chance to fire or wipe regularly twice a week, and spent all his leisure time at the roundhouse.

One morning, a little over twenty years ago, I went down to take the "Esmeralda" out, and noticed on the bulletin this legend:

"Train 12, engine '77, Engineer, Alexander, Fireman, Thompson."

"Thompson? Thompson?" said I, half to myself, "what fireman is that?"

"'Cy' Thompson, used to be call boy," said the foreman; "why, you know 'Cy' Thompson." So you see at last "Cy." started out on his career under the guidance of the greatest water boiler and train jerker on earth—myself.

"Cy" was soon changed off to a regular freight, and became one of our best firemen. We all felt a great respect for "Cy."; his father was killed at Shiloh, and he supported his widowed mother until her death, which occurred shortly after he went firing. He was cleanly, orderly, studious, and a pleasant fellow to have around.

"Cy." used to go out in society some, and when he went it was always in the best circles; first he took one girl, then another, once in a while being seen with a daughter of our general manager—but he seemed to have no regular, steady company.

As near as I can remember, it was '72 or '73 that "Cy." was promoted. He attended strictly to business, and inside of six months had the reputation of being the best freight man on the road—he was a success—the officers were pleased, his companions on the road glad, and "Cy." himself ought to have been more or less satisfied with himself, but he wa'n't.

All at once there came a great change over "Cy." I noticed it first when he commenced to run his engine into town without taking off his overclothes; then he got to loafing around the roundhouse half the time, puttering around his engine, telling stories or reading. He would come in and stay around the house hours before he would wash up, and the high-water line advanced steadily from his shoulders to his ears, and finally he only washed around his mouth, except on Sunday.

He bought cheap, ill-fitting clothes that were always ripped, or had buttons off, or wrinkled in the back.

"Cy." ate his lunch up the road one day without washing his hands, and his fireman said he was as bad as a pig, he did so again, and someone else said he was a hog, and I never knew how it all came about, but it wa'n't long before we were all calling him "Hogskin" Thompson, and I don't know but what he deserved it.

"Hogskin" Thompson never lost his reputation as a good runner; he made his engine his home and his idol; she was the cleanest and best in the service, but "Hogskin" was kept off a passenger run when his turn came, all on account of his personal habits, he saved money, but pshaw, any one can save money who gets a man's wages, and lives like a hog.

During the centennial, "Hogskin's" only sister came home from the West, bringing a little son three or four years old. "Hogskin" laid off two weeks to entertain her, washed clear down to the skin, and bought himself a decent suit of clothes, but I don't believe he took his sister any place; he devoted himself to that boy—bought him clothes, whole suits, took him everywhere a boy would want to go, and loaded him down with playthings. But just as quick as the sister went home "Hogskin" relapsed into his old habits.

I saw that the defenseless side of "Hogskin's" fortress was the children's side; if he was to be recalled from associating with himself alone it would be through his love of little children; women he had absolutely ignored since he changed his name from "Cy." to "Hogskin."

I invited him up to my place once, and he came and played all evening on the floor with the children, and seemed to enjoy it, but he wouldn't come again. When Fred had the scarlet fever, "Hogskin" asked after him every day, and sent him fruit, and flowers, and sweetmeats, and years afterward I found out that he did the same when any child was sick that he knew of. He bought many a pair of little shoes, filled many a little stomach, and many a poor mother had cause to feel sorry when "Hogskin" Thompson was banished from New England; but bless you, I never heard of his good deeds till after he had gone.

The strike of '77 sent a good many of us out West, but "Hogskin" Thompson was one of the first to leave for "parts unknown." He came up to bid me good-by, and I walked down to the depot with him, and going down there he told me the cause of his great change.

He had loved a daughter of the old man's—our general manager—and when he was promoted and proved himself a good engineer, had considered that he was worthy of her, as good as she, as clean and pure, as well educated and as well born, and had told her so, asking her to marry him. She thought well of him, but her father, who had become rich, pooh-poohed the whole idea, and talked the foolish girl into the belief that she was made of a superior sort of brickdust, and she declined him. If he had tried the bold knight not-to-be bluffed-or-fooled-with plan, the girl would have broken her father's law, and, I doubt not, her own neck, to have gotten him, but he went off into a half-morose, half-mad pet, and kept up his don't-care mien, and failed to wash his neck, and answered to the name of "Hogskin," till I rather guess the girl was glad she didn't get him.

"Hogskin" Thompson passed out of sight, and out of mind. Our boys were scattered far and near, and, of course, the fellows that took our mills did not know "Hogskin"; as for me, I thought of him once in a while, for a year or two, and inquired for him when I met some of the old gang, but I don't believe I had thought of him for ten straight years until the other day—then I met him face to face in the streets of Boston.

He didn't look much like the "Hogskin" Thompson that was exiled after the strike, but I knew him just the same. He wore a plug hat, and a good suit of clothes, had a clean, stand-up collar, patent leather shoes, side whiskers, and that same old smile he wore when he was "Cy.," and before he became "Hogskin"—I knew him by the smile.

I stepped up, stuck out my fin, and said: "This is Mr. Thompson, I believe; Cyrus Thompson?"

He wrapped my hand up in his, looked me in the eye, and said:

"'Hogskin' Thompson, sure enough; but bless me if you don't stick me—but keep still, let me see; can't be Alexander—old John Alexander, well, well, I be darned; how are you, old man?"

He pulled my flipper through his elbow, and we started off down street like a couple of boys; he asked me about eleven hundred questions, and I got in a little over a thousand on him when we brought up at the door of Young's hotel; nothing would do but I must come in and lunch with him, so in I went.

We went up to the parlor, and before my eyes had just got used to the light, in rushed about as handsome a young lady as you'd wish to look at, throws her arms around Thompson's neck, and calls him a dear, old papa, and wants to know where in the world he has been.

That girl was born long before '77, if I am any judge; and I am just trying to get it straight when in comes another, perhaps seven—a little dream of loveliness—and she has hugs for "papa," too.

That oldest girl is no daughter of "Cy.'s," and she certainly can't be the mother of the little one; but "Cy." sees my perplexity, and, winking at me gravely, he formally introduces each as his daughter, and—we all lunch.

A bright and happy pair of girls are these, and Thompson seems devoted to them.

Thompson and his girls went home with me that afternoon; the girls captured the heart of Mrs. A. on sight, and inside of fifteen minutes owned the place, and had taken possession.

But that night, long after they were in bed, Thompson told Mrs. A. and I how he came by them, and if it ain't equal to a romance then there is no romance on the railroad.

Sitting in the room I call my "den," Thompson and I mingled the smoke of our cheroots, and went over our lives since '77, until the house was still, then Mrs. A.—woman fashion—came in with her crochet work and sat down to listen until there was a lull in the conversation, when she put in her oar.

"I felt so sorry for your little girl to-night, Mr. Thompson," said she; "her and our Bess were playing with their dolls, and she said: 'I just wish I had a mamma like you has, I ain't got a mamma at all, and I do want one *so* bad; papa says my mamma got lost, but she will turn up all right one of these days, but I *do* want one just awfully awful, so I do.'"

Thompson laid his cigar on the window sill, crossed his legs, clasped his hands over his knee, and said: "I guess I'll have to tell you where and how I got those girls, but say nothing to them, they are happy as they are."

Now I'm trying to tell this just as Thompson told it to us. He said:

"When I left here in '77 I went to New York, where I looked around for a few days, and then took steamer for New Orleans. I hunted work around there for some time, but gradually worked my way west into Texas, where I finally struck a job; it was not much of a road then, but it is now; I kept the job, however, as I had learned by experience that jobs were far from being plentiful. They gave me an old engine that was in pretty bad shape, and as there was no shop on the road worth the name, I concluded to put the old scrap in as good repair as possible myself.

"I worked nights and Sundays facing valves, packing packing, filing brasses, etc., etc., until the old Roger was the best engine on the road. In order to do this I spent much of my time in my overclothes, and at the engine, and am afraid that I was about as untidy as ever, for it wasn't long before they were calling me 'Hogskin' Thompson again; I don't know where they got the name, I suppose I must have given it away myself.

"My run was over a desolate part of the country, good enough for grazing, perhaps, but not much else; houses were few and far between, and towns still scarcer.

"Away out on the middle of the division there was a family living in a hut formerly built by the graders on the road; this family had apparently squatted here and occupied the cabin, and had attempted, in a half hearted way, to cultivate a little strip of land along a creek bottom.

"There was an old wagon, with the bows for cover still up, standing near, one horse usually ambled around with his front feet hobbled, and a half starved cow was often seen tied to the wheel of the wagon, everything in the surroundings betokened abject poverty.

"The man was a typical 'mover' from the Southern States; he could be seen, as a usual thing, sitting on the sod banking on the shady side of the house idly whipping the ground with a stick, or smoking his cob pipe and gazing at the horizon with his brain absolutely at rest, he was laziness personified.

"The woman's form was often to be seen in the little garden, but her back was always turned, and a sun-bonnet forever covered up her head.

"The liveliest creature around there was a little girl five or six years old. She always stood barefooted and open-eyed beside the track when we went by.

"I noticed that she had made little houses and yards by sticking up twigs in the ground, and had made animals of cobs with legs of twigs. One day I bought a nice, dressed doll, put it in a box, and threw it to her, when I went back she had it in her arms, and smiled at me—we were acquainted. I got her shoes, stockings, hat and many other things, and threw them to her, and she wore them. I got to whistle for her as we came in sight, and, rain or shine she was out to see me, and the doll was always clasped to her little breast, dirtier each trip, but always there.

"The woman was not to be seen the next spring for some time, so one day I slowed down, and asked the little lady where her ma was; she answered simply, 'sick.'

"Coming back next day, I stole a large piece of ice out of an empty refrigerator car, and threw it off, and did so every trip for a week or more.

"But one day my little friend stood in the doorway of the hut, weeping as if her heart would break, and the Cracker stood outside with his hat off, in an awed manner, that told me at once that the mother had gone to her long home. I stopped, consulted my watch, and found we could stay there an hour, if necessary, then I went over to the Cracker. The little girl came running to me, laid her little head on my shoulder, and sobbed as if her heart would break, at last telling me her poor, dear mamma was dead, and 'all cold.'

"The Cracker moved up, and said:

"'Yes, sir, she's dead.'

"'How long ago?' I asked.

"'Yesterday.'

"'Any neighbors?'

"'No.'

"'What can we do for you?'

"'She left some writin', sir.'

"I took off my greasy cap, and stepped inside the cabin, it was barren enough, but clean; on the poor bed lay the wasted form of a once beautiful woman—once the picture of Lottie—she had evidently died of consumption.

"The Cracker took up a copy of the Book of Mormon, turned to the fly-leaf in the back, and handed it to me, saying,

"'I don't read.'

"I took it, and in faint pencil lines, but a handsome script, I read:

"'Bury me under the cottonwood by the brook. I am 28 years of age. Lottie was born at Salt Lake, Utah, June 4, 1873. I was the third wife. Her true name is Lottie M——'

"That was all; even the name was carried away by the dead; the writing bore evidence of having been done a little at a time, probably after the sufferer got too weak to use the pencil.

"Our crew dug a grave by the tree near the cabin, and wrapping the sheet around the wasted form, we laid it in the shallow opening and covered it over, the little girl weeping, and the father standing idly by, with a troubled look on his face.

"He said they had plenty in the house, and that he would pick up his traps, and move into town at once, where I promised to find him, and help him to get work, and put the little one in school.

"Our time was short now, so we hurried away, and I shall never forget the weeping little figure that stood outside the cabin, holding her doll, and watching us out of sight. The next day, going back, I noted that the cabin was deserted, and the wagon gone, and ten miles further on I passed the outfit; the one old horse hitched to the double wagon, the pole strapped up to his side, the weather-beaten cow limping along behind, and the Cracker sitting on the corner of the wagon box, his feet on the whiffletree, and his cob pipe between his teeth; he did not look up as we passed—perhaps he was thinking—I did not see the little girl.

"I went out the next night on the coal train, and ten miles the *other side* of the deserted cabin I saw something ahead, between the rails, that looked like a cyote or a dog, going from us, but when we got within a hundred feet or so, it stepped out of the way, and turned and looked toward the engine—it was my little girl.

"Clasped in her arms was her precious dolly, and in a little paper sack she had some corn bread, and a few childish trifles, as I afterward found. I called for brakes, left the engine with the fireman, and jumped off opposite her. She was overjoyed to see me, and said she was going home to my house to stay. I took her into the cab, and at the first stop turned her loose in my lunch pail—she was ravenous.

"I learned from her that she had followed my train away from the house two days before. She said that man wasn't her own papa, and she was afraid of him, and he wasn't good to her. When we got to the other end of the road the cracker was there, and saw Lottie, said he 'knowed she would go on the track till she met me, and that he didn't spend any time hunting for her.'

"He sold his outfit, got half drunk the next day, and came and wanted me to give him fifty dollars for his share in the girl. I told him I would give him the money, if he would get sober and tell me all he knew about Lottie and her mother. He said he would do it, but that I would find it a greater and wickeder story than I had ever read of in a book. I arranged that he should meet me the next morning and tell me the story.

"That evening I made arrangements with the sisters of a boarding school to take the girl until she was 15 years of age, and coming to my boarding house, through the yard, saw a lot of lanterns and a crowd around one of the switch engines; I went over to see what was the matter, and found that they had run over and mangled a man. I held a lamp down to the upturned face—it was my Cracker—Lottie's story was sealed up, and the key cast into the unknown ocean of eternity.

"I at once adopted her legally, filled out the name her mother had written in the book to Lottie M. Thompson, and she has now forgotten that she ever was anything else. Her influence made a man of me again. I 'braced up,' changed my appearance and name back from 'Hogskin' to 'Cy.,' and was happy, devoting my time and attention between runs to my new daughter."

Thompson picked up his cigar, lit it, and leaned back in his chair to watch the smoke curl toward the ceiling. Mrs. A wiped her eye on a corner of her apron, and I kept still.

"Whatever became of old man Hodges, John?" asked Thompson, by way of turning the subject. Hodges was our old general manager.

"Dead these five years," said I.

"Died pretty poor, too," spoke up Mrs. A., "lost money every move he made, late years, lost his wife, then the old homestead, and then his position; he was keeping books before he died. Clara supported him towards the last."

"Who did she marry?" asked Thompson.

"Nobody; never married, and it's a shame, too," (that sounds just like a woman). "Clara would have made some man a good wife, she's just as nice as she can be. She sews, why, she made this dress I have on, lives over at Newton, just opposite the depot;—but Mr Thompson, you never told us where you got your little girl—the one you call Dolor—that's a curious name."

"I forgot that, Mrs. Alexander. Her story is shorter and more mysterious than Lottie's," said he.

"Shortly after I found Lottie, my care of my Roger attracted the old man's attention, and he made me master mechanic. I held this job a couple of years or more, and was then made superintendent, and finally general superintendent. I held this position until six years ago this month, when our general manager died, and I was chosen to succeed him.

"Shortly after I took charge we acquired control of some other lines that placed in our hands quite a 'system,' and I went over all the lines to inspect and report on them. Time was limited, and I must be back in headquarters within a given time that called for my car traveling all night, and the next day. My engineer was worn out, and there was no one available to relieve him, so I agreed to run the engine over one division myself, letting the engineer sleep in the car.

"It was a dark night, but in nice weather, and we made very fast time, and I am ready to swear that I never took my eyes off the track for a minute, and did not see an obstruction. After running fifty six miles we stopped for water, and I started out to oil a little, remarking to the fireman that it seemed like old times. In going around the pilot I was horrified to find blood on the flag staff on my side, and a piece of torn black lace in a sliver on the pilot. In going back to the cab something white attracted my attention, laying on the running board between the cab and the air pump—it was a large wicker basket with a cover; I took it down carefully, and opened it, and there, sleeping peacefully, with her thumb in her mouth, was a girl baby five or six months old. She was neatly dressed, and on a button of her little slip was a bit of paper, on which was written the single word 'Dolores'—we call her 'Dolor.'

"I side-tracked my special till daylight and stopped all trains, then we went back over that fifty-six miles of track, but there was nowhere any sign of an accident, and none has ever been reported. Whether we killed that child's mother that night, or whether the child was put on the running board, and left to its fate, I never knew. The presence of the paper with the child's name would indicate the latter. Certainly it must have been there a long time, for the meshes of the basket were full of cinders. I adopted her at once, and she is a little jewel, too.

"Romantic, wasn't it?" said Thompson, knocking some ashes off his vest.

Then Mrs. A. wiped her eyes, and went up to bed, saying good night.

The next morning Thompson asked Mrs. A. to keep his girls for a day or two—which she was more than ready to do.

"Going to town with me, Thompson?" said I.

"No," said he, "I'm going to Newton."

What Will Cure Thoughtlessness.

Late in March there was an accident on the Staten Island road, a locomotive and one passenger car plunging into an open draw. The engineer claims that he did not see the danger signal until too late, being busy with something on the engine. Accidents of this kind are quite common, and only go to prove that, in addition to the regular signal, an auxiliary audible signal should be used to call attention. The *Railroad Gazette* has the following on the subject:

"This drawbridge accident was similar to that at Oakland, Cal., a year ago, except that in this case no one was killed or injured. There are, however, three points worthy of mention in the Port Richmond case. First, the engineman was intending to resign within a day or two to take a better job. No one can assert that the unusual matters on his mind exerted an undue pressure to drive out thoughts of his immediate duty, but cases like this and like that of the English runner, not long ago, who was worrying about a sick wife at home when he let his train run away, inevitably raise the question, How can runners with preoccupied minds be made to lie off? This is an obscure and ineradicable difficulty, but it is by no means certain that nothing can be done to mitigate it. Trainmasters who habitually permit men to work excessive hours when there is a rush of freight are responsible for *not* mitigating this evil, for their practice directly encourages men to take the risk of going upon an engine when their minds are unfit for work. A derailing switch is one radical cure for absent-mindedness. Second, the fireman was a temporary one, taken from the shop, and had not been examined. Examination rules must be rigid or the single dropped stitch will turn out to be the most important in the whole chain. Third, the drawbridge exists for the sole benefit of a single lumber yard. Drawbridges that are opened every day cause blasphemy enough, for the cases in which a scow-full of garbage hinders a thousand passengers are increasingly common, but here is a case where hundreds or thousands of passengers must daily ride over a specially dangerous spot, because a boatman wishes to go through once or twice a week. Quite likely the infrequency of the danger signal at this point was a factor in the runner's failure to observe it, but that only further illustrates the unnecessary burden placed upon a railroad by the multiplication of danger points."

J. H. Agnew has made such a record as superintendent of machinery of the South Carolina road in the last two years that he has been chosen as general superintendent. Mr Agnew is a young man yet, a progressive, earnest man, who has come up through the machinery department, and knows his business from A to Z. He will be general manager of some road in ten years—unless the world comes to an end.

The Erie has issued a pamphlet entitled *Summer Homes*, that is unique. It has a brief description of all towns on the road, within 150 miles of New York. Tells the distance, fares, population, and points of interest, and gives a list of hotels and boarding houses with their capacities, prices, etc. All this is done for the purpose of interesting people and building up a business for the road, and there are no advertisements in the book. It is a credit to the passenger department

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Circulation Liars—For Advertising Only.

The majority of railroad papers of this country are published for advertising purposes absolutely and solely. Stop their advertisements and they would starve in a month. Their whole effort is to please their advertisers and make them, and prospective advertisers, believe that railroad officials can hardly operate their departments on days that their particular paper does not show up.

They distinctly disclaim any subscribers or readers among the train or enginemen, and sneer to advertisers about this paper as an "employes' paper," of no use to anybody who has goods to sell.

Not long ago the *Railway Gazette* published an advertisement claiming to have more railroad officers as subscribers than all other papers combined. This stirred 'em all up, and some want committees to investigate, and others want to bet, and still others say the *Gazette* lies.

Now if the *Gazette* had said that they had more subscribers among the men who daily handle the trains and locomotives of this country, or the men who repair or build locomotives, not one of its *esteemed contemporaries* would have noticed it in the reading columns, and every advertisement hunter would have held the fact up to dealers and manufacturers as a reason why they should *not* advertise in it.

Facts are facts, and we do not believe we can be successfully disputed when we say that any one of the railroad papers would do anything on earth that a paper dare do to get and control advertising; they will show up and endorse, either by actual words, inference, or silence, any device that is manifestly of no earthly use to a road, if the promoters will only advertise. That is what they are publishing papers for.

Most of the papers make a specialty of one thing, and are pretty good in that line; thus the *Gazette* keeps a very good record of new roads, changes in name and in management, and sloshes around in a little of everything in the railroad line. The *Age* publishes a full record of accidents and financial news of interest to stockholders. The *Review* pays considerable attention to rate wars, but is, of late, the best edited weekly in the field. The *Master Mechanic* has a list of railroad offices, and has considerable in it about locomotives and cars, evidently written by men more familiar with the theoretical than the practical side of the subject, and the *National Car and Locomotive Builder* is the only one, other than THE LOCOMOTIVE ENGINEER, publishing matter of practical use to the men in the motive power and rolling stock departments. Yet they are careful to announce emphatically that "employes" don't take their paper.

There is a local railroad paper published at St. Paul that devotes a little of its space to cussing and discussing State railroad commissioners, rate wars, condemning strikes and strikers, and publishing advertisements. It has taken a hand in the fight, and calmly stands up and says who and which are the *leading* railroad papers. We quote:

"The fact is, of course, that the claim of the *Railroad Gazette* is ridiculous. The *Gazette* is a good paper—not as good as it has been nor half as good as it thinks it is—but we doubt if its circulation is any bigger than that of any one of the other papers mentioned, while it is quite certain that the combined circulation of any two of the half dozen leading railroad papers (which are the *Gazette*, the *Review*, the *Age*, the *National Car and Locomotive Builder*, the *Master Mechanic* and the *Northwestern Railroader*) will largely outweigh the circulation of any other one. To talk of any one paper having more subscribers than 'all others combined' is pure foolishness and pure falsehood.

"When it comes to a 'show down' of subscription lists the *Northwestern Railroader* itself will be on hand with a few surprises."

Mr. Forney's paper is not "in it." Forney does not run his paper exclusively to control advertising. THE LOCOMOTIVE ENGINEER is not "in it"—those dirty, greasy engineers read it.

Now the facts are these. Two of these "leading papers" cannot prove an honest, paid circulation of 3,000, and not one of them can show 4,000, and all run a big "free list." We do not know what circulation Mr. Forney's *Engineering Journal* has, but will venture to say that it is at least equal to any of those in the fight.

THE LOCOMOTIVE ENGINEER'S monthly edition of 16,000 copies does not all go to railroad officials, but they do get over a thousand of them.

The paper is published in the interest of the men, and to aid in supplying better service on the road and in the shop, and we don't want any man to take it who won't acknowledge that it has given him information worth ten times its cost in expediting his work, and making him a more useful and better posted man.

There is an era of education and improvement just opening up among the rank and file, and this paper is devoted to widening and developing that very field. THE LOCOMOTIVE ENGINEER *is* an "employes' paper"; it aims to make them better engineers, firemen or machinists, and claims that in so doing it is worth ten times as much to any road as any of its advertising contemporaries.

Next January will see a substantial increase of our list, and if every advertiser quits we will go on, and prosper. But advertisers won't quit; they will see the cat in this puzzle picture pretty soon, and kick out the advertising fiend who argues against a paper because it is read and respected by the bone and sinews of our roads—the men on the locomotives.

THE LOCOMOTIVE ENGINEER has 212 subscribers in Australia; have any of the other papers got that many in one of our own States? THE LOCOMOTIVE ENGINEER has 665 subscribers in the State of Michigan; 771 in New York, and over 500 in each of eight other States; it goes to every State and territory, and to many foreign countries—there is a neat little club of nearly a hundred at the City of Mexico; there is a club at Colon, Isthmus of Panama, and another at Solmgpur, India.

When the L. E. shows it has an audience, and many of the seats in the bald-headed row are occupied by railroad officers.

These circulation liars—for advertising only—make us weary, exceedingly weary.

Under the title of "The Newspaper Affidavit Liar" some unknown poet has left this crystal—it hits the point exactly:

The snake liar and the fish liar, both bowed in their gray old age,
Came traveling back from their journeys wide, from their earth-wide pilgrimage;
A tear drop stood in the snake liar's eye, and the fish liar groaned in pain,
And a death-like look of infinite grief came over the face of the twain.

"I cannot compete with the modern liar,' the sad-eyed snake liar said,
"In its limitless length and breadth and depth, and I wish that I were dead;
For I stand rebuked with a shame-faced look 'neath the triumphant gaze of the eye
Of the newspaper affidavit liar, with his circulation lie.

"For the snake liar and the fish liar and the horse liar own his sway,
And the easy going liars who work by the job, and the liars who work by the day;
The traveling liar, old inhabitant liar, and liars of low degree,
And liars who lie for the fun of the thing, and liars who lie for a fee.

"The horse liar, the peach crop liar, the sea-serpent liar and all,
With the wide, untraveled wastes of cheek and their soul less seas of gall,
All bend the knee to the sceptered sway of this crowned and peerless one,
And the father of lies looks tenderly down on his most accomplished son."

Book Review.

THE OFFICIAL RAILWAY LIST. Railway Purchasing Agent Company, Chicago. Price, $2.00.

This little book contains the names and addresses of all the operative officers of the North American railways, the names of traveling representatives of the different railway supply houses who advertise in the book and there are few who don't. The book is a handy size to carry, and is of great value to men who require a work of this kind.

CAR LUBRICATION. By W. E. Hall, B. S., M. E. John Wiley & Sons, 53 East Tenth Street, N. Y. Price, $1.00.

This is a neat little work by a practical man, assistant master mechanic at the Altoona shops of the Pennsylvania. The work treats of the design and material of journals and journal bearings, as well as the means of lubricating, and the value of the different kinds of lubricant. The book is especially valuable to men in charge of car repairs and maintenance.

ASKED & ANSWERED

(50) T. R. S., Brooklyn, asks:

If you plug up the hole in top of Richardson's balanced valve will it make any difference with the balance? *A*.—The hole is put there to allow any steam that may leak through the packing to escape to the exhaust; if it were closed a very slight leak would put as much load on the valve as there would be on a plain valve.

(51) Cal, Barstow, Cal., asks

How can I ascertain the amount of coal on a platform by measuring the same? *A*.—A bushel of bituminous coal weighs 76 pounds, and lump coal weighs about 50 pounds per cubic foot. By measuring your pile you can easily figure pounds and bushels. In measuring an uneven pile of coal, it is best to measure from a point where the coal is near maximum thickness and average the ragged edges, and estimate separately.

(52) Fireman, Arkansas City, asks:

1. Kindly state in your next issue how to chain front wheels of engine trucks in case of broken flange, wheel or broken journal. 2. What is the pressure in cylinder per square inch when steam gauge shows 140 per square inch; and oblige. *A*.—1. If enough of the broken wheel remains on axle so that it can be blocked, and the pair slid, do so; if the axle is broken, jack up the front of the truck and chain it up to the main frame of the engine. 2. The mean effective pressure (the average pressure) in the cylinder is figured as about half that in the boiler.

(53) S. & H., Wilmington, N. C., write.

Will you please inform two of your readers whether there is any set of rules for fitting with hydraulic pressure? There is no rule in our shop, and it's guess work. We refer to crank-pins, both steel and iron, also, driving axles, etc. Please give us some general information on this subject, and greatly oblige. *A*.—The general rule is to press axles into wheels with a pressure of nine tons per inch of axle diameter; thus, a six-inch axle would be forced home with a pressure of 54 tons. Crank-pins are forced home, when the hole is true and smooth, with a pressure of six tons; but if the hole is rough or uneven, this pressure is increased to as high as nine tons. A few shops make nine tons per inch of diameter the limit for axles and pins—no difference being made between steel and iron.

(54) B. H., Gordon, Pa., asks

1. What causes the right glass in a Nathan lubricator to break? We have one engine that it is impossible to keep a glass in. *A*.—If the right glass breaks more than the others, there is some local cause that puts an extra strain on the glass. Look for it. 2. Suppose you break both eccentric blades on one side. If you take off the back-up blade on the left side and put it in place of the right go-ahead, will the engine go? *A*.—Yes, if full-stroked slowly; but it would be quicker, safer and easier to take down the main rod and run on one side. 3. Does water, carried in the top gauge cock, cover the flues at front end of a Cushing 72" boiler on a grade of 120 feet per mile, wheel base of engine 51 feet? *A*.—You have no engines with that wheel base, you are counting the tank. Top gauge should cover heating surface with water on any grade the engine has to stand on. Get length of boiler and height of gauge above tubes, and figure it out yourself. There are 5,280 feet per mile. When there is water in sight in the glass, or at the lower cock, a man ought to feel safe about his heating surfaces on any grade; if not, the gauges should be raised.

(55) G. Cochener, Waco, Tex., asks

1. What about side rods pounding? Some of the boys here say they do, others say not. If they don't pound, what is the use of keys on side rod straps? *A*.—Side rods will not pound as a main rod will, but will rattle and chuck sideways very hard. Most of the trouble is caused by their being keyed too long or too short, so that they force the pins to or from each other when on the rigid points—the centers—this sounds like pounding. Keys are employed more to get the rods the proper length than to keep the brasses close to the pin. 2. What causes an engine to strip her side rods in slipping on a hill after running all right? *A*.—Side rods give motion to the second pair of wheels only after the first pair have used up as much as they can without slipping—they get what power is "spilled over." If the forward pair slip from striking grease or some such cause, the side rods are called upon to transmit the full power of the engine, and often fail to do so. Rods are very often broken, when keyed too short, by the sudden dropping of one wheel into a depression just as the side rod is on the center. The distance between the pins causes a rupture, and the engine "strips herself." Side rods should be keyed loosely on the pins on dead centers when the engine is hot, and ought to be loose enough on the pins to rattle. There is little danger of a side rod letting loose that will rattle in service.

One of the N. Y. Central's new passenger engines recently pulled a seven-car train, weighing, exclusive of passengers, 515,700 pounds, from Buffalo to this city, 440 miles, in eight hours and thirty-four minutes, almost fifty one miles per hour. The engine and tender weigh 201,500, this was no special, or race, but the every day train a little late.

Progressive Examination of Locomotive Engineers and Firemen.

By John A. Hill.

[Final Examination, after Three Years.]

Q. Suppose you were called to-night to go out in charge of an engine, what would you do on arriving at engine in the yard?

A. First look at the crown sheet and flues; satisfy myself about the water level; see that there was fuel and water on the tender, that her headlight and signals were in shape, and that she was supplied with necessary tools and sand; then inspect her machinery and oil around.

Q. Suppose you were to take the engine over the road without a train?

A. I should report for orders, and examine and check up the train register.

Q. Suppose you get out ten miles, between stations, with your train, and break down, what is your first duty?

A. To protect myself, both front and rear, against approaching trains.

Q. Suppose there was no train due coming toward you for some time, or you had the absolute right of the road—is it still necessary to flag?

A. Not always; still it is an additional safeguard, and takes little time and trouble to put out a flag or torpedoes.

Q. How high would you carry water in the boiler?

A. So that there would be steam and water show at the top gauge cock, or what is known as a "flutter."

Q. Why not carry solid water in the top gauge?

A. Because it is then uncertain how much water is being carried, and too much water is dangerous, in that it leaves very little steam room, and causes water to be carried over into the cylinders, cutting valves and packing, endangering the heads, and throwing water and ashes over the engine.

Q. Would there be exceptions to this rule?

A. Yes. In approaching a summit, enough water would have to be carried so that the engine could pitch over without uncovering her crown sheet.

Q. Suppose, after pitching over, you had only a "flutter" in the lower gauge cock, what would you do?

A. Keep supplying water, but instruct fireman to keep the fire bright, to prevent flues from leaking.

Q. Suppose your injectors stop working on the road, what would you do?

A. Stop, see if there was water in the tank. If the instrument would prime I should conclude that the trouble was in the injector, or the check, and attempt to fix them; but if it would not prime strongly, should take down hose, clean the strainer and wash out hose by opening the tank valve.

Q. What about your water level all this time?

A. Should watch that; open fire-door in the start to prevent popping off, and if water got low, should bank fire. If I had a pump, would take down and examine valves.

Q. Why is it that left-hand injectors and pumps are so seldom in working order?

A. Because they are neglected, not used, and not kept packed. They should be used every day.

Q. What is the difference between foaming and priming in a boiler?

A. Foaming is caused by oil, alkali, soda, or any such foreign matter that causes the water to assume the form of suds. Priming is when the whole or a large part of the water in the boiler lifts, caused by want of space for the steam formed to free itself, generally occurring when a boiler is being forced very hard.

Q. How can you usually detect foaming? and what would you do if your boiler commenced to foam on the road?

A. Foaming is generally indicated by the appearance of water at the stack. The valves are dried and pull the lever, and often valves or pistons will squeak or groan. When this occurs I would at once shut off throttle and let the water settle, to ascertain if boiler was actually foaming or had been over pumped. If there were three solid gauges of water, would conclude that there was no foaming; if water sank to or below lower gauge, should decide that there was foaming, and should keep up supply of water. If boiler had a surface blow-off cock, would use it, supplying extra water for it by the left injector or pump; would open cylinder cocks, to prevent damage to heads, reducing speed if necessary; should shut off occasionally, to be sure of my water level. In this way bad water can usually be gotten rid of. At first water station would try and have enough water so as to be enabled to blow out a couple of gauges of water.

Q. Suppose that you discovered that, through accident or design, there had been oil put in your tank?

A. Should proceed just as I have said until a water tank was reached, then would take water, allowing tender tank to overflow for a long time; this would carry off any substance that would float. Using the heaters would materially assist in raising the oil and sending it back to manhole.

Q. Suppose you found that you couldn't shut off the blow off cock, or you broke it off?

A. Should knock out fire at once, disconnect the engine, and send to telegraph office for assistance.

Q. In this case what would you disconnect?

A. Would take down the main rods and disconnect valve stems.

Q. Suppose you found that the tank valve had come off the stem and dropped into the seat, preventing the injector or pump from getting water, how would you get it out without stopping?

A. Put on the heater strong enough to blow it out of the seat; heater should be shut off quickly, to prevent rupture of hose.

Q. Suppose you were stopped on the road, and found that the water had dropped out of sight, what would you do?

A. By opening the throttle, or blower, the water level can sometimes be raised, as in working; if found it still low, would deaden fire by throwing water on it, shaking it out, or covering it with fine green coal.

Q. Suppose you found, on the road, that the throttle was disconnected and open, what would you do?

A. Reduce the pressure, so that I could handle the reverse lever safely, if the train had hand brakes, would notify the crew and ask them to act promptly; if I had air, would use it carefully, to avoid breaking in two; would take train to first telegraph station and report condition to headquarters.

Q. Suppose it became disconnected while closed?

A. My action would be governed considerably by the circumstances; would at once protect myself against approaching trains, send to nearest telegraph office for assistance, fill the boiler well up with water, knock out the fire, and blow off steam, unless, in very severe winter weather, I would thus endanger freezing up. If near division roundhouse on busy line, would disconnect and prepare to be towed in. If it was not a busy line, and no trains would be badly delayed, would take up dome cap and try to connect up the valve again.

Q. Suppose a flue got to blowing very badly?

A. Would plug it up.

Q. Suppose the whistle or one of the pops blew out of dome cap?

A. Would plug the hole with a wooden pin, tying it in with the bell-cord, held by a wooden lever.

Q. What would you do first if a check valve were knocked off?

A. Kill the fire, to protect crown sheet.

Q. Suppose when your throttle was closed you could not prevent some steam from getting into cylinders, what work would you report?

A. Should be sure the steam did not enter through the oil pipes before reporting a leaky throttle.

Q. How could you tell a leaky throttle from a leaky dry pipe?

A. The dry pipe will generally leak water if boiler is filled up pretty well.

Q. How would you go to work to disconnect an engine that had broken a steam chest?

A. Take up the chest cover and fit pieces of board over the steam passages to the chest, if they were on the cylinder casting, build up on top of them, using wood, the valve, or anything handy for the purpose; then bolt the cover down hard enough to prevent steam from entering the chest; disconnect the valve stem, take down the main rod, shove the piston ahead, and cramp the gland enough to hold it. If the steam pipe was connected direct to chest, and there were studs enough, or enough of the chest left, would try to block up the steam-pipe opening with wood and hold it in by fish plates and bolts.

Q. Why wouldn't you cover the ports with the valve?

A. Because no steam can enter the cylinder.

Q. What usually ruptures steam chests and covers?

A. Excessive pressure, generally caused by reversing the engine when running fast. This makes air-pumps of the pistons that fill the chests, steam and dry pipes, finally breaking the weakest.

Q. In case it becomes necessary to reverse, how can you prevent rupture of chests?

A. By opening the throttle it will be impossible to get more than boiler pressure in the chests, and they are designed to carry that.

Q. Suppose you struck something that demolished one cylinder and chest, how would you disconnect so as to run in?

A. Take down main rod, take valve stem off the rocker, or tie up the end so that it could vibrate; open the front end, loosen a steam pipe, and insert a piece of sheet metal in the joint, and tighten it up, or take out pipe entirely and bolt a piece of board over T-pipe.

Q. What would you do if you broke the reach rod?

A. Would fit blocks in top of link slots, so as to hold links as high as I wanted to cut off, as I could not reverse, would have to run carefully.

Q. If you broke a lifter?

A. Would fit a block in link, as for broken reach rod; take off lifter, engine must not be reversed in this condition, as one side would be in forward gear and one in back.

Q. If a piston rod broke and knocked the forward head out, how would you disconnect?

A. Place valve over center of ports, disconnect the stem, and fasten it there by cramping the gland, or blocking, if a metallic packing was in use.

Q. Why wouldn't you take down the main rod?

A. Because it could do no harm by moving the piston.

Q. Suppose you had an engine with only one pump in working order, and you broke a valve on that side, how would you get in?

A. Would cover ports with a smooth board, lay valve on top, block it from moving in chest, and block above enough to hold it down; put down cover, disconnect valve stem, take piston out of crosshead, and let main rod remain up, to work the pump.

Q. What would you do if you blew out a piston gland, breaking off one lug and one stud?

A. Would take out most of the packing, so as to let gland clear into stuffing-box, and bolt the lug solid to head by remaining stud.

Q. Suppose you broke off both lugs?

A. Engines have been run this way by wrapping the outside of gland body with cloth, a piece of overall stuff or signal flag, and forcing it well into the box by a jack, or by using wooden blocks between it and the crosshead. In case the body of gland was broken, would disconnect that side.

Q. Should you slip the right back motion eccentric on the road, how would you reset it?

A. Would place the engine on exact dead center on right side, place the reverse lever in full forward gear, and make a mark on the valve rod at the stuffing-box gland; then place the reverse lever in full back gear, and turn the slipped eccentric until the mark on valve rod came to its original position, being careful to see that the full, or throw of the eccentric, was in position nearly opposite the forward eccentric, then secure it there.

Q. In what way does the mark you made on the valve rod, while in forward gear, aid you in setting the slipped eccentric?

A. The forward motion eccentric being in proper position, by placing the reverse lever in full forward gear the valve is brought into proper position on the ports, and the mark gives the position of the valve when the back motion eccentric is in its proper position, thus setting the slipped eccentric by the good one.

Q. Should a valve yoke break, how would you test in order to determine which side was disabled?

A. Would first place the engine at half stroke on the right side, and admit a little steam to the cylinders, then move the reverse lever from back to forward motion, and if the steam could be shifted from the back to the forward cylinder cock, would conclude that the right yoke was good, and would test the left side in the same way.

Q. Why would you place your engine at half stroke on the side you wished to test?

A. In order to get the full movement of the valve over the ports on that side.

Q. After locating the broken yoke, how would you disconnect?

A. Would take off the steam chest lid, place the valve over the ports, and block it there securely, replace the lid, take off the valve rod, take off the main rod, block the crossheads, and proceed with a little over half a train to next telegraph office, report, and give judgment as to whether the engine would take entire train to its destination.

Q. Should you blow or break out a cylinder head, how would you disconnect?

A. First, take off the valve rod and close the ports with the valve, and secure it by cramping with the stuffing-box gland; take off the main rod and block the crossheads.

Q. How would you proceed to block the crossheads securely?

A. By placing crosshead at one end of stroke, and placing a block between end of crosshead and guide blocks, to prevent it from moving, would secure the block to the guides with cord to prevent any danger of its falling out.

Q. Is it always necessary to so securely block crosshead?

A. No. Where possible, the piston should be placed at one end of the cylinder and the valve placed at same end of the chest, so that the pressure will securely hold it in place.

Q. Does it make any difference which end it is placed at?

A. On engines having a driver back of the guides the forward pin will sometimes strike the piston key if the crosshead is blocked back; in this class of engines it should be blocked ahead or key removed.

Q. How can you tell the difference between valves blowing and cylinder packing blowing?

A. Valves blow more steadily than does cylinder packing. If you put reverse lever in center, and open throttle and cylinder cocks, you can test the valve; if they are tight, steam can only blow from one cylinder cock out of the four. If, in starting slow with cylinder cocks open, you watch the crosshead as it leaves the ends of stroke, you can at once locate the blow, both by sight and by hearing.

Q. In case you located it in right piston, what would you report?

A. Examine cylinder packing, right side.

Q. Why do you say cylinder packing? it's the piston that is packed.

A. To avoid confounding it with the piston rod packing.

Q. Suppose you broke the back-up eccentric blade on one side?

A. If there was no danger of link swinging against other parts of machinery would run ahead in full stroke with only the back-up blade down.

Q. Why not hook up?

A. Because that would cause the eccentric to swing the link around the link block pin, instead of moving the pin back and forth.

Q. Should you break a forward eccentric strap?

A. Take off both, cover the ports, and take down main rod?

Q. If you broke a lower rocker arm?

A. Would take down main rod, cover ports with the valve, and, if the piece of rocker hanging to link block pin could not strike anything, would let it alone.

Q. What if you broke the top rocker?

A. Would do the same, blocking the broken piece where it could not be struck.

Q. Suppose the pin in link saddle broke off?

A. Would take down hanger, block up on top of link, just as if the hanger or tumbling shaft was broken.

Q. What would you do if both front cylinder heads were broken?

A. Disconnect both sides.

Q. What would you do if one of the bridges between the ports should break out?

A. Cover all the ports with the valve, fasten it, take down valve stem, main rod, and block crosshead.

Q. What would you do if the soft plug blew out of crown-sheet on the road?

A. Protect train and disconnect both sides.

Q. How about the fire?

A. Water and steam from the plug would put that out.

Q. If you broke a crosshead?

A. Take down main rod, cover ports, and disconnect valve stem.

Q. Should you break the back section of a side rod on a six wheel connected engine, what would you do?

A. Would take off both back sections, and run in with main and forward wheels connected, with lighter train.

Q. Should you break a forward section, how would you disconnect?

A. Would take off all side rods and run in without train.

Q. Should you break a back or front section of a side rod on a consolidation engine, how would you disconnect?

A. Would take off both back or front connections, as the case may be, and run in with two-thirds of train.

Q. Should you break a middle connection on a consolidation engine, how would you disconnect?

A. Would take off all side rods and run in without train.

Q. Should you break a main crank-pin close up to the wheel, how would you disconnect?

A. Would take off all side rods, and the main rod on disabled side, and run in without train.

Q. Should one of the forward tires on a ten-wheel engine break, how would you manage?

A. Would jack the wheel up the thickness of the tire, take out the oil cellar, and cut a block to fit the bottom of the box and journal sufficiently thick to hold the axle up in its place when resting on the pedestal brace; would then run in without disconnecting, provided the rod had not been bent or damaged by the broken tire; would take in full train.

Q. Should you break a main tire, how would you manage?

A. Would first send messenger to nearest telegraph office and ask for assistance. Would then block up the axle and wheel the thickness of the tire, slack off the side and main rod keys, and run in carefully without train.

Q. Should the back tire break, how would you manage?

A. Would take off the back section of rods, block up the axle, run very carefully—especially around curves—to nearest telegraph office, report, and ask for orders.

Q. What would you do in case you lost off the back driving-wheel tire on an eight-wheeled engine?

A. Would block up wheel, take down side rods, and run very carefully to first telegraph station.

Q. How fast would you run in that condition?

A. On straight track, five or six miles per hour; on curves and over switches, very slow.

Q. Would it be safe for you to back up under those conditions?

A. No; there would be nothing to guide the engine.

Q. What would you do in case the back tank truck broke down so that you could use no part of it?

A. Would put a car truck under, if available; if not, would jack up tank and put forward truck back, chaining front of tender to frame of engine, would lighten load on tank as much as possible and run in light.

Q. What would you do if an axle in engine truck of an eight-wheeler broke?

A. Jack up that end of the truck and chain it to main frame of the engine.

Q. Suppose the front axle under tender broke?

A. Would jack up truck frame, and chain it to a cross-tie, or rail, laid across top of tank.

Q. Suppose you broke a wheel under the tank—say you lost about a third of it?

A. Would use a tie or piece of rail to block that pair of wheels from turning, and would slide them to the nearest telegraph station.

Q. Should you break a front driver spring or spring hanger, what would you do?

A. Would take the spring out, run the back drivers upon wedges to take the weight off the forward drivers, and block between the top of driving-box and frame; then run the forward drivers upon wedges to take weight off the back drivers, pry up the end of equalizer and block it level.

Q. If a back spring?

A. Would proceed same as in case of front spring, but in reverse order; would not take spring out if there was no danger of its falling to pieces, as it would consume too much time.

Q. What size wedges would you use to run your drivers upon, and how would you get them when needed?

A. I would use wedges of oak, about three feet long and four inches square, eight or ten inches of the top of wedge straight for wheel to rest on, and would see that I always had them on my engine ready for use.

Q. Suppose you were running an engine with a pony truck, and broke the center pin at front of long equalizer, what would you do?

A. Put in a new pin, if I had it, and could do it quickly, if not, would jack up front of engine and block down the cross equalizer at back of long equalizer, enough to prevent forward end from striking pony axle, and proceed with full train.

Q. In case of failure of water supply in tank under ordinary circumstances, what would you do?

A. I should leave my train and run to a water tank, except it was practicable to obtain a supply from some pond or stream near by.

Q. In case of snow blockade, and water low in tank, what would you do?

A. I should shovel snow in tender, and in this way make water enough to keep engine alive.

Q. Tell me how you would start a heavy train.

A. Should pull out easily, starting one car at a time, getting all in motion before opening engine out—this to avoid breaking train in two.

Q. After the train got to going nicely what would you do?

A. Hook the reverse lever nearer the center

Q. What good does that do?

A. Steam is worked expansively.

Q. How?

A. The steam is admitted to the cylinder for a shorter time, and the supply is then shut off, allowing that imprisoned in the cylinder to be expanded down to a lower pressure, thus doing work

Q. What do you mean when you say "cutting off in six inches"?

A. That steam is admitted for six inches of the travel of the piston, or rather that when the piston has gone six inches from the end of the cylinder the valve has closed the port, and what steam is then in the cylinder is used expansively.

Q. What is lead?

A. The opening of the port at the beginning of the stroke.

Q. Does it increase by hooking up?

A. Yes; the earlier the cut off, the more lead.

Q. What is lap—outside lap?

A. The distance that the edges of the valve overlap the outside of the steam ports. If the valve is two inches wider than the ports, it is said to have one inch lap—an inch on each side.

Q. What is the object of lap?

A. Lap is given for the purpose of enabling the engine to work steam expansively. Steam is held in the cylinder, and is expanding while the valve is traveling the distance of its lap.

Q. What is inside lap?

A. The distance that the inside edges of the exhaust cavity of the valve overlap the outside edges of the bridges when the valve is in the center

Q. What is its use?

A. It delays the exhaust, and therefore gets a little more work out of the expanding steam. It is not used on fast engines, as it is then desirable to get rid of the steam quickly.

Q. Could you change the lap or lead of your engine by adjusting the lengths of the eccentric blades?

A. No. Lap can only be changed by adding to or cutting off part of the valve. Lead can only be changed by moving the eccentric on the shaft.

Q. What can be done by moving the blades?

A. The valve can be made to travel evenly each side of the center of seat, that is all.

Q. If the lead can only be changed by the position of the eccentric on the axle, how is it increased as the links are hooked up?

A. The whole motion is moved back around the eccentric, instead of the eccentric being moved ahead through the motion, which amounts to the same thing.

Q. Is it your duty to adjust this motion?

A. No. I am to run the engine, and report such work at the roundhouse

Q. What work about the engine should you do?

A. I should adjust the wedges, keep the rods properly keyed up, all stuffing-boxes packed, and care for the headlight.

Q. How should wedges be set up?

A. They should be set up while engine is under steam, and be adjusted tight enough so as not to thump or knock, and yet allow the box to move freely in the pedestals. This is best done by moving them up tight, and then pulling them down enough to relieve the side pressure. Much damage can be done by getting them too tight and by adjusting them too often.

Q. How would you go about setting them up?

A. Would place the engine at half stroke on the right side, block the left wheels, admit a little steam, and thump the boxes hard away from the wedges. Would then get under, and put the wedges up solid with a short wrench, and make a side mark on the pedestals at top of wedge, then draw them down equally one-eighth of an inch; go over the left side in the same manner.

Q. How would you keep up or adjust the side rods of a ten-wheel or a consolidation engine?

A. Would place the engine on a level and straight track, and on a dead center, then slack off all keys on that side, would then key the main connection first, leaving it sufficiently free on the pin to be moved laterally by hand, then adjust the front and back ends in the same manner, before starting to key up rods, would see that wedges were properly set up

Q. Why would you place the engine on exact dead center, and begin by keying the main connection first?

A. In order to insure keying the rods of proper length to allow them to pass the dead or rigid points without strain.

Q. Can the side rods be keyed too long or too short when not standing on dead center?

A. They can.

Q. If too long or too short, at what point of the stroke will the strain be?

A. While passing the dead or rigid points.

Q. What provision should be made in the rods for the uneven movement of the wheels in the pedestals?

A. The brasses should be loose enough on the pins to accommodate the movement mentioned.

Q. How does an injector work?

A. Steam escaping from a boiler has a velocity many times higher than water would escaping from the same sized orifice and under the same pressure The steam used in the injector imparts to the water a measure of its velocity, at the same time giving up most of its heat It is enabled to deliver the feed water at the check at a greater velocity than water would escape directly into the air from the boiler.

Q. What is the difference between a lifting and a non-lifting injector?

A. The lifter has an extra steam jet ahead of the combining tube that draws the air out of the injector, allowing the pressure of the atmosphere to force the water in the tank up into the instrument.

Q. What make of injectors are in use on this road?

A. ———.

Q. How do you make a heater of that instrument?

A. ———.

Q. How should an injector be used?

A. Water should be supplied constantly while engine is at work, and the injector regulated to just supply the boiler.

Q. What brakes are in use on this road?

A. ———.

Q. What is meant by an automatic brake?

A. One that is self-operative under certain conditions.

Q. What is the principle of the automatic air-brake?

A. Air under pressure is supplied to the train, and a sufficient quantity stored on each car to do the braking of that car. This stored air, however, is held in equilibrium by the pressure in the train pipe. A reduction in the train pipe destroys this equilibrium, and the stored pressure, through the medium of the triple valve, sets the brake in proportion to the reduction in the train pipe. Should the train break in two, or any other accident happen that would rupture the train pipe, the brakes on each section would be automatically applied.

Q. What is meant by "straight air"?

A. The term "straight air" is used to designate the original Westinghouse system, which operates the brakes by applying the air pressure from the engine reservoir directly through the pipes to the brake cylinders of cars.

Q. What is your duty regarding air brakes before coupling engine to a train?

A. The air-pump is to be started and lubricated for the trip, maximum pressure pumped up with which to charge the brakes, and those which may be set should be released.

Q. What is your duty as soon as engine is attached to train?

A. First, charge the brakes, second, apply brakes at full force and hold them on while brakemen or inspectors go over train to make sure that all brakes are set; upon their signal, brakes are released; then wait for report regarding number and condition of brakes before starting out.

Q. How would you start your pump?

A. Would start slowly, and increase speed gradually, and thereby not force out the water of condensation, which would be injurious to the pump.

Q. How would you lubricate your air-pump?

A. I would lubricate steam cylinder with cylinder oil, and air cylinder sparingly with a small quantity of engine oil; would not use tallow or lard oils in air cylinder.

Q. Does water accumulate in air reservoir and air pipe? if so, what should be done to remove it?

A. Yes, the moisture in the air will condense and accumulate in the main reservoir, which should be drained off once a week in summer and daily in winter.

Q. How would brakes be applied in making ordinary stops for stations?

A. For ordinary stops the brakes should be applied lightly, by opening engineer's valve, and closing again slowly until the pressure has been reduced on the gauge from four to eight pounds

Q. When are brakes fully applied?

A. Brakes are fully applied when pressure, as shown on the gauge, is reduced twenty pounds.

Q. Should brakes be held fully applied until train comes to a full stop?

A. No.

Q. Why?

A. Because it causes a reaction in the motion of the train, which is very disagreeable to passengers.

Q. How can this be avoided?

A. By releasing brakes gradually before a full stop, so that all the air will be off at the moment stop is made.

Q. If some brakes are sticking after the train has started, how may they be released?

A. If all the excess pressure has been exhausted, or the amount is not sufficient to release brakes, the engineer's brake valve is put at "lap" and speed of air-pump increased, as soon as fifteen or twenty pounds additional pressure has accumulated in main reservoir, brake valve is thrown into releasing position, and kept there from ten to twenty seconds. If this does not release brakes, use the proper signals, calling attention of trainmen to release brakes by hand

Q. What is the maximum air pressure allowed on passenger trains?

A. Eighty pounds

Q. What is the maximum pressure allowed on freight trains?

A. Seventy pounds.

Q. With a passenger train of from twelve to fifteen cars, what air pressure would you keep the brake charged with, and how would you handle the brakes in making a stop?

A. Would carry from seventy to eighty pounds pressure. In making a stop, would apply brakes gently, reducing the pressure from four to eight pounds, as might be found necessary, and then gradually increase the pressure on brakes until train is brought nearly to a stop, without releasing the brakes more than once.

Q. Give the different positions of engineer's brake valve handle.

A. First, releasing position, handle against left-hand stop.

Second, running position, handle against middle stop.

Third, at lap, handle on left of service stop or service stop notch.

Fourth, applying position, handle to right. In the old valve the suddenness of application of brakes depends on distance to which handle is moved to right of middle stop.

Fifth, emergency position, stop to extreme right—only to be used to avoid accident.

As soon as all slack is taken up, would gradually increase the force of brakes as circumstances required, being careful to reduce the pressure on train pipe gradually, so as not to use full braking power until absolutely necessary. The object is to gently bring the slack against the air-brake cars, and to hold the brakes on until the train comes to a full stop.

Q. Suppose you were running this train thirty miles an hour, and, on looking back, found one or two cars at the rear were off the track, what would you do?

A. Shut off and apply air very gently, and call for brakes. If I applied the emergency brake it would very likely cause a bad pile-up of cars, as the brakes would all be ahead.

Q. Given a full train of freight cars, all connected with air-brakes, what air pressure would you carry, and how would you handle the brake in making a stop?

A. Would carry the pressure prescribed for freight trains—from sixty to sixty five pounds. In making stop would reduce pressure slightly, just enough to set brakes over entire train simultaneously, and gradually increase braking power until train is brought to a stop, releasing the brake, after once set, as seldom as possible. If the old style engineer's brake valve be opened wide, allowing the pressure to escape quickly, the brakes on a long train will set on front end some time before those on rear end, causing the cars to jam together with destructive force; then, if the engineer's brake valve be closed quickly, without giving time for the pressure to become equalized throughout the entire train, the forward brakes will become released, resulting in a severe jerk that will, perhaps, break the train in two. In any case, the use of brakes so released is lost. The new equalizing pressure valve automatically takes care of this itself.

Q. Give essential points to be observed in holding a train of air brake cars, while descending heavy grades.

A. 1. Have train charged with maximum pressure before bringing brake into use.

2. Regulating the force of brakes so as to maintain a regular and steady speed of train, also make as long a distance as possible to each application of the brakes. By doing this the pressure is used economically, and the pump is given more time to accumulate the necessary pressure for recharging.

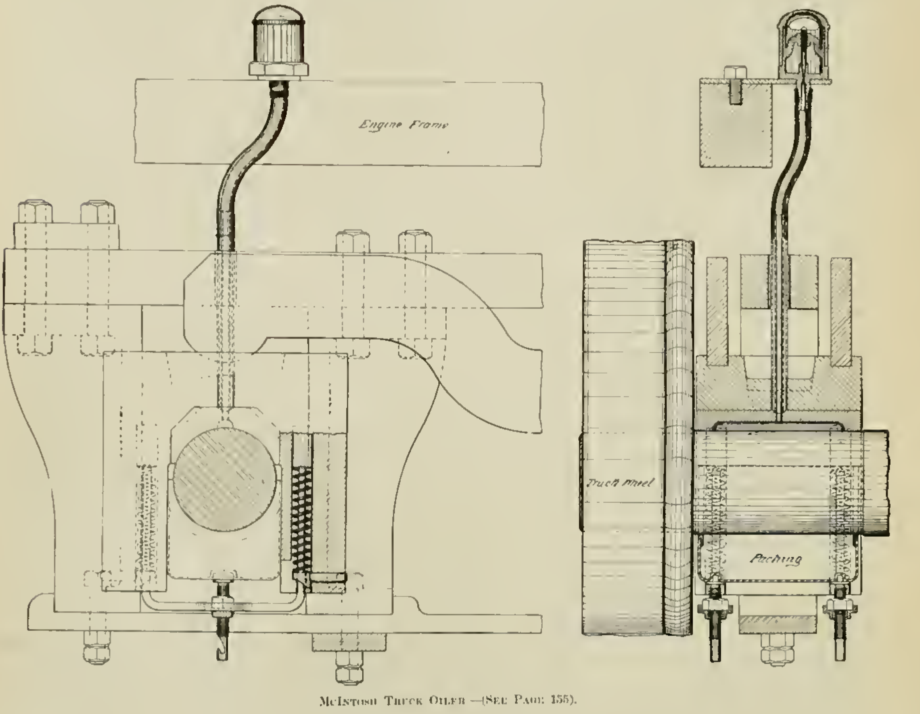
3. Always keeping brake valve in releasing position while recharging, thereby giving the brakes the greatest advantage in recharging quickly.

4. Making no new application of brakes until the full amount of pressure consumed in previous application has been restored.

5. Reducing the pressure, as shown on gauge, not more than fifteen to twenty pounds from one recharging to another, as it would be difficult to replenish the full amount in so short a time. Moreover, when the pressure, as shown on gauge, has been reduced twenty pounds, the brakes have been fully applied, and any further reduction is a waste of pressure.

Q. What is a pressure-retaining valve?

A. It is a small weighted valve, attached by a pipe to the exhaust cavity of the triple valve case,



McIntosh Truck Oiler.—(See Page 155).

Q. How much pressure would you carry on a passenger train of two to four coaches, and why?

A. Would carry same pressure for all passenger trains, regardless of the number of cars; because, with the automatic air brake, each car carries its own reservoir, charged with a pressure to be used for a given stop, and is, therefore, subject to the same braking power, regardless of the number of cars on the train.

Q. Given a freight train of thirty to forty cars, from five to fifteen of these in front end of train are equipped with air-brakes and can be used to aid in stopping the train, at what pressure would you keep the brakes charged, and how handle the brakes in making a stop?

A. Would carry from sixty to sixty-five pounds pressure. In making stop would apply the brakes gently by reducing pressure from four to five pounds; this will be sufficient to let the cars run together, with only a slight jar on any of them.

Q. What is the object of the pressure-retaining valve?

A. The object of this valve is to hold a portion of the pressure in brake cylinder. while the brake is being recharged when descending heavy grades.

Q. What are the two positions for handle of the pressure retaining valve, and what is action of valve in each?

A. Perpendicular, handle of valve is turned down; this allows the entire pressure to escape from brake cylinder when brake is released. Horizontal, handle is turned up; this retains a pressure of ten pounds in brake cylinder, but permits all pressure over that amount to escape when brake is released.

Q. When "double headers" are run, by whom and how should air-brakes be used?

A. By head engineer alone; second engineer closes stop-cock in train pipe under his valve, or, in absence of this stop-cock, he places engineer's valve in the "lap" position, in order to give forward engineer complete control of brakes. Second engineer also keeps his air pump working, and thus has air pressure ready for any emergency, such as failure of air pump on forward engine, in which case forward engineer proceeds as second engineer would in case just stated.

Q. The second engineer having once assumed control of the brakes, how long should he retain charge of same?

A. Until the end of the trip, except in a case of necessity, which may again reverse the operation.

Q. What should always be borne in mind when on mountain grades?

A. To keep train well under control

Q. Should descending at high speeds be practiced?

A No.

Q. Why not?

A. Descending at high speed must not be practiced with any train, for there may come a time when some part of the machinery may fail, and, while practicable to control speed by hand brakes at eight to ten miles per hour, it may be impossible at twenty to thirty miles per hour to regain its control.

Q. Are you familiar with the use of driver brakes on locomotives?

A. ——.

Q. How do you apply them?

A. I apply the brakes gradually, in order not to bring a too sudden strain on the brake rods and lever.

Q Would you reverse your engine when driver brakes are set?

A. I would not.

Q What would be the probable result of reversing engine with driver brakes set?

A. The effect would be to lock and slide the wheels, resulting in flat tires.

Q. In case of failure to any part of air or driver brakes during the trip, what would you do?

A. Report it promptly to master mechanic or foreman for inspection and repairs.

Q. What extra air-brake parts should you always carry on your engine?

A. I should always have on engine one extra hose for connection between engine and tank, and one hose for between tank and car.

LECTURE.

Your weakest point, as shown by this examination, is in . . . . You need to post up a little on that. I do not know just how soon you will be called upon to run an engine, but I wish to impress upon your mind the fact that you must not now, or then, sit down satisfied with yourself because you have passed this examination. The master mechanic or the traveling engineer have a right to demand that you be re-examined, if they think it necessary, should your promotion be delayed for another year.

The mechanical world is moving all the time—keep up with the procession.

It is not particularly necessary that you know how things are made, but do know *how* they work and *why* they work.

Study up every new brake, injector, or other device, so that in case you run across one you will understand its principle and can work it intelligently.

I cannot refrain at this time from calling your attention to the necessity of getting a good reputation on the road, and not a bad one.

If there is disagreeable work to do, do it as cheerfully as possible and with little "kicking." Say you *can't* pull cars after you have tried—never before.

Get the reputation of oiling around, taking water and getting ready to move quickly. Get the reputation of running on the road evenly, occupying card time between stations, and not running fast and stopping often.

If you find it necessary to run fast to a station for a meeting point, commence to run fast right then—not at the last moment. Get the reputation of doing well, and on time, anything you set out to do with an engine Make your fireman your partner; show him all your orders, interest him in his work and the engine—he will be of great service to you—and above all, don't forget that you fired a long time yourself.

Avoid the reputation of being "fly" on the road. Never be reckless or foolish; it's a grave business. Don't let your thoughts wander from your work Accept the responsibilities of your position with your eyes open and hand firm—just as a successful surgeon uses the knife near the vitals—know what you are doing and how to do it, just how far to go, and where to stop. A nervous, excitable, uncertain engineer is as dangerous as an ignorant one.

Don't ask many favors or make many kicks, so that when you do ask a favor it will be more likely to be granted, and when you do kick it will count.

Don't do anything because some engineer you know or like does so, unless you know he is right. Know *why*, and then do as your knowledge of the subject teaches you is right and best. You have an individuality of your own—develop it.

I wish to impress upon your mind the importance of telling the truth about affairs on the road. Never make out a false report about killing stock, or accidents. Tell the plain, naked, bald-headed truth—even when it shows you were in the wrong—it will be noticed and known, and credit given you for it; but once you get caught making out a lying report—and you will get caught if you do it—your word won't help you much in an important case. Lying to save a man's job is a pretty good way to jeopardize it when the lie is discovered. Railroad officers have a wholesome respect for a man who dare say, "I did so-and-so; it was a mistake," or, "It was my fault."

I hope you will pass your examination on time-card and rules before the superintendent successfully, but would advise you not to try until you are pretty sure

If you are temperate and industrious, I don't see why you should not become an engineer that every officer of the road will be proud of.

McIntosh's Automatic Oil Cellar.

The illustration on page 154 represents a self-adjusting oil cellar in use on the Chicago & Northwestern, the invention of Wm. McIntosh, master mechanic at Winona, Minn

Into the flanges of the truck axle box four holes are drilled from the bottom, into which the ends of two U shaped yokes, fitted with coil springs, are inserted. These springs bear against heads on the yokes, and are put under tension, and kept in the holes by collars below them on the stems of the yokes, said collars being held up by a key driven through the side of the flange, as shown at the bottom of each spring. The cellar is of thin material and fitted loosely in the box, held up only by the springs and yokes. The tension of the springs can be increased by set-screws located in each yoke under the cellar, these set-screws have a chisel point that fits a recess in the bottom of cellar, preventing the screw from turning and working itself loose.

The set-screws have hooked heads, and a rod can be laid in the hooks of the two, and the whole cellar pulled down by hand to examine, replenish or change the waste.

It is evident that with this arrangement the cellar packing must at all times be kept in full contact with the journal, insuring good lubrication.

In addition to this, Mr. McIntosh locates a large oil cup in a convenient and get-at-able place on the frame of the engine, and connects it by a pipe and hose to top of the box, as shown; this does away with the necessity for maintaining a gob of waste, cinders and oil on the top of the box, and guessing that the oil part gets down and attends to business and the cinders lay still and behave themselves.

Grief on the English Roads.

In the *Railway Herald* (London, Eng.) for July 11 there are a couple of pages of letters from correspondents, setting forth some of their troubles. We quote a few samples. How is this for examination questions

. . . In your issue of July 4th there appeared a letter on examination, written by one who signs himself "Truth." I think, however, your correspondent has not heard all the truth about the passing of firemen at Leeds I conclude that he has written his letter on account of two firemen who have lately failed to pass their examination, and been put back for six months. I will now state a few facts:

One fireman, after firing for seven years, was asked to point out his "sheaves or tumblers," and, incredible as it seems, could not do so. Now this shows that the man has taken very little interest in his work, and is not fit for a driver, as he does not know the different parts of his engine; and in my estimation the rejection of such a man is a duty to the public. Again, one of the candidates was asked to point out his "left trig-end" and failed to do so. No one could reasonably expect such a man to be placed in charge of an engine. Your correspondent asserts that they have three men to pass at Leeds; they have no more to pass there than anywhere else. There is the driver on whose engine the candidate is placed, the Westinghouse brake official, and lastly, Mr. Anderson, the locomotive superintendent, to pass, before he can be elected. The questions asked are always very simple and rudimentary. . . .

LOW WAGES AND RESPONSIBILITY.

"Struggles" reply to "English Tom's" "How to live, maintain and clothe a family of six on a weekly wage of 18s., paid fortnightly." "Struggles" says he cannot understand why a signalman in an important box should be paid less than an engine driver, when, he says, the signalman has perhaps eighty levers to deal with and all the trains, against the driver's one lever and one train. I should imagine "Struggles" has a very poor knowledge of what is taking place on the footplate; perhaps he is under the same delusion as I myself used to be before I started in the railway service. I used to stand on the bridge at one of our stations in the Midlands, and picture to myself what a fine life a driver and fireman have got, never for once thinking of the dangers and the inclement weather they were exposed to. Perhaps "Struggles" thinks that one lever and one train is all an engineman has got to think about, but far from that. If he be a diligent man he has to be on the alert from the time he signs on duty till the time he signs off. If he has not to work bodily he has to work mentally. It is the question of money that caused me to write. Now, I myself am a fireman in receipt of 4s. 9d. per day of ten hours. When first I entered the steam shed I was paid 15s. per week; remember there were no tips, and find your own clothes. From that time up to the present—though I have been very attentive to my work—it has taken me fourteen years to work up to a first-class fireman. What will it take to work up to a first-class engineman? Yet "Struggles" seems to me to begrudge us the money. I say let every man get as much as he can. I should be only too pleased to see all classes of railway servants better paid. An engine driver and fireman have a deal to do that many do not know about. We get no annual leave paid for, nor clothes, with the exception of an overcoat. When we are booked off we are not paid. I do not think there are many important boxes with eighty levers in that are not double-manned, so the anxiety of the signalman is greatly reduced. I do not know a lot about signalmen's duty in large boxes; there is another thing—I do not want to, either What we want, Mr. Editor, is to try and help each other to better our positions. . . .

Block signal dangers are shown by a Great Western engine driver as follows:

Don't rely too much on signals, because they often fail with the change of the weather. Only last Saturday, July 4th, a distant signal at Reading failed to act; when the train was approaching the up south cabin distant signal, which was standing at all right, when going round the curve the home signal stood at danger, and I looked back and saw the distant signal still off; the automatic vacuum brake had to be applied with full force, and the train was pulled up in a very short distance. The train was traveling at about fifty or fifty-five miles per hour, and I told the signalman when passing his cabin that the distant signal was off. The answer was that he could not see the signal from his cabin; it was beginning to get dusk at the time. Why not employ a locking bar close to such far signals from the signal cabins. If the signal then wouldn't go back to danger properly the signalman wouldn't be able to lock it, and then he would have to adjust his signal wire so that he could lock it. . . .

The "oldest man" racket must be in force there. Can any of your readers say, 1st, whether or not it is true that a porter of the relieving staff has been promoted to Canning Town, North Junction box, which I am given to understand is a fourth class, eight-hours box?

2d. Whether any signalman in an inferior position has had the opportunity of refusing the job?

3d Supposing the porter of the relieving staff to have been promoted as suggested in the first question, for what meritorious action was he raised from a relieving porter to an eight-hours signalman?

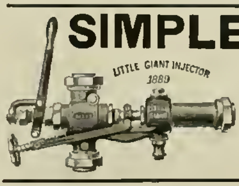
There seems to be evidence of long hours, low pay, strict observance of rules, and few privileges given to "railway servants" over there, though it is shown that the companies are making money.

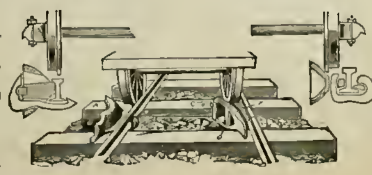
Geo. Royal, Jr., a well-known young engineer of the Wisconsin Central, has accepted the Chicago agency for the Lee Composite Railway Paint, the Ajax Metal Co. and the National Car Spring Co. George was a success on his engine and there is no doubt that he will be one in the supply field.

The Master Car Builders' rules of interchange were revised at Cape May this year, and will go into effect September 1st, 1891. Secretary Cloud already has them out and ready for distribution. The price will remain the same as before, 25 copies, $1; 50 copies, $1.75; and 100 copies, $3; smaller quantities, 5 cents each

The Brazilian system of railways now in operation comprises about 6,000 miles, while 2,500 miles are in contemplation, and will probably be constructed within the next few years The government owns and controls fourteen of the eighty-four different lines, while in thirty-five a partial control is still maintained.—*Bradstreet's*.

The *Engineering Magazine* has appeared in place of *Engineering*, which only appeared once. This was a wise move on the part of the publishers, as the English paper *Engineering* already has a world wide reputation. The *Engineering Magazine* treats on general engineering topics, for the benefit of those interested in a general way in engineering. No editor is announced, but the leading papers are signed by well-known writers on special subjects. The publication is of the regulation magazine size and style. Price, $3 per year.





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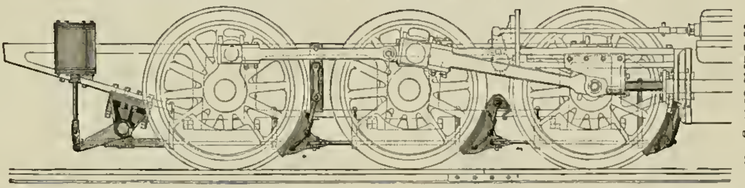

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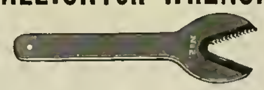

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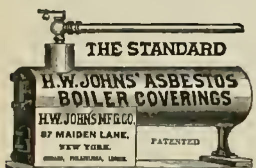

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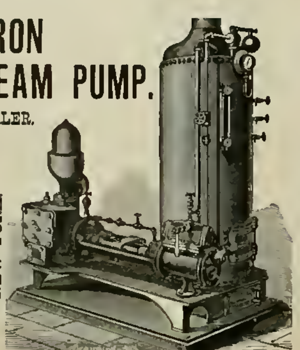

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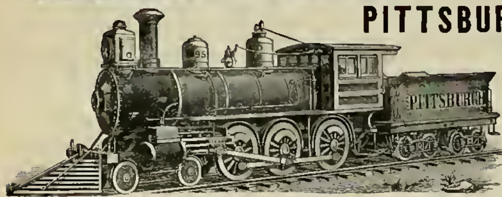

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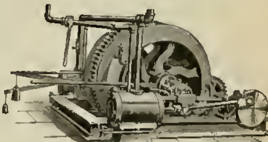

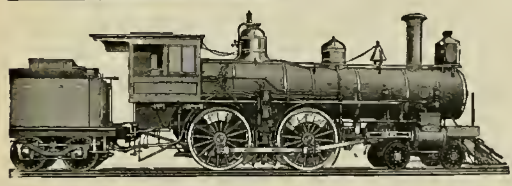

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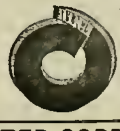

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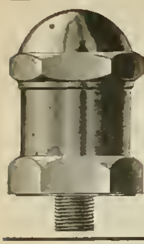

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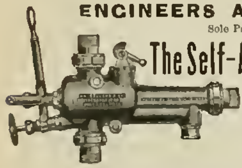

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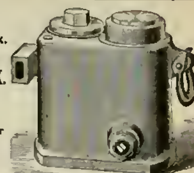

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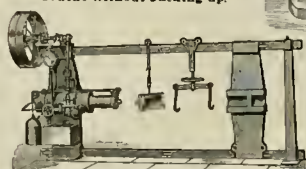

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Which is acknowledged by authorities and accorded the confidence of the manufacturers throughout the United States and foreign countries, is manufactured exclusively by G. W. Lord, practical chemist and inventor. Attention is called to other parties, who, through the appropriation of G. W. Lord's antiquated patent, have deluded many manufacturers into presenting them with their order for Lord's Boiler Compound. The use of the above formula, patented in 1869 by Mr. G. W. Lord, has been long discontinued by him, owing to his discovery of many new chemicals, which upon critical experiment have demonstrated their superiority. Lord's Boiler Compound, manufactured at the present time, is an article greatly superior to the formulæ patented by Mr. G. W. Lord. For decrees of court, etc., address G. W. LORD, 320 Union Street, Philadelphia, Pa.

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VOL. IV, NO. 9. NEW YORK, SEPTEMBER, 1891. $1.00 per Year or 10c. a copy.

Details of a Model Soft Coal Burner.

Of all the fine appearing locomotives that run into the city of Chicago, the new eight-wheelers, Class 26A, built at the Rock Island shops there, are in the lead.

For a good many years this road has built and used "Twombly engines." These machines had their work all right, and saved the Rock Island hundreds of thousands of dollars, but many of them were unnecessarily ugly.

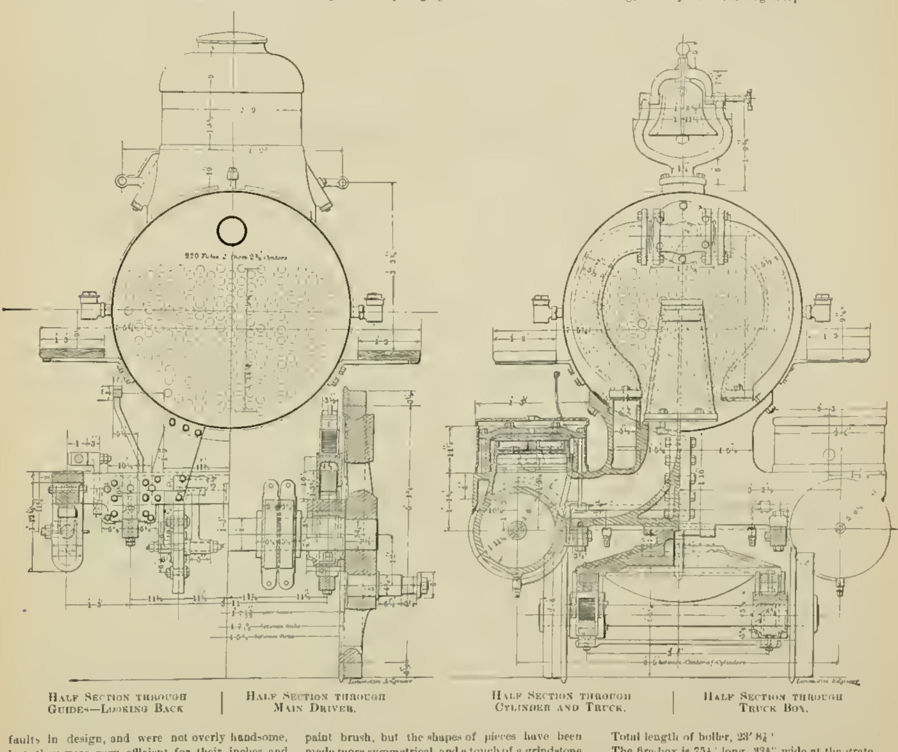
Mr George F Wilson, the present superintendent of motive power, has discarded none of Mr. Twombly's cheap and good devices. He has retained cast-iron where its service has been satisfactory, and many forgings are still finished with the

The boilers, cylinders and frames of these engines are heavy and carefully made

THE BOILER

The boiler is of the wagon-top variety, with crown bars, has an extension front, and brick arch.

The shell is 56 inches in diameter at the smallest ring, and 62½ across the wagon top



Half Section through Guides—Looking Back | Half Section through Main Driver. | Half Section through Cylinder and Truck. | Half Section through Truck Box.

faults in design, and were not overly handsome, but they were very efficient for their inches and weight, and Mr. Twombly was a long way in advance of his neighbors in getting rid of brass and polish, and making locomotives for utility He used a great deal of cast-iron and rough forgings, finished with a paint brush. These pieces did paint brush, but the shapes of pieces have been made more symmetrical, and a touch of a grindstone here and there has made some of the castings look like planed wrought-iron

The new engines have splendid boilers. We spoke about some of the details of their construction in our issue of February last

Total length of boiler, 23' 8¼"

The fire-box is 75¼" long, 33⅜" wide at the grate, 55" at the crown sheet and 78" deep

The shell is of ½" steel, and the fire-box of ⅜" steel, excepting the flue sheet, which is ½

The vertical seams are double riveted, lapped 4½", ¾" rivets, pitched 2¾" apart. These seams have a patch welt 10" wide on the lower side, and extending about a third of the way around the boiler.

The horizontal seams are lapped 4½", and have an inside welt 11' wide. There are four rows of ⅝" rivets, spaced 2¾" apart on the two lap rows, and 3½" on outside or welt rows.

All the seams in the fire-box are single-riveted on 2½' lap, with ¾" rivets, 2" pitch.

The sides and back of fire-box are stayed with ⅞" stays, spaced 4" apart, the water space being 3½".

There are 220 tubes, 2" diameter and 11' 7½" long.

Heating surface in tubes, 1,336.7 square feet; in fire-box, 145 square feet; total, 1,481.7. Grate area, 17.6 square feet.

The excellent plan of staying this boiler is fully shown in the drawings, particular attention being called to the independent feet of the crown bars. These are of cast-steel, free to move on the loose rivet shown, and supporting the double bar on shoulders on each side, said shoulders being rounded to admit of considerable movement. This plan insures a sure footing for each bar, and admits of using a very cheap form of crown bar—one that can be made in the bulldozer. The extension is of the Barnes pattern.

THE ENGINE.

The frame of this engine is heavy for her cylinder, and a great deal of care is taken in putting it together. Your attention is called to the manner of fitting the lower rail of frame between the driving-boxes, and the manner of fastening the splice. The frame ahead of the first box is 4½"x3¾", and between the boxes, 5½"x3¾".

The cylinders are heavy for 18", and a very heavy balanced valve of their own make is used.

The principal dimensions of the engine are given on the drawings. Suffice it if we describe it in engineers' parlance as "wheel, carrying 150 pounds pressure."

"Eighteen by twenty-four, five foot eight and three-quarter Laird guides are used. They are of cast-iron, the top guide being 4" thick in the center and 9¼" wide. No trouble whatever is had with this guide, or any other cast-iron bearing where ample bearing surface is provided.

The rocker arm is also of cast-iron, but is just the shape of a wrought arm. They are touched up a little on a grindstone, and are painted a very light lead color, looking at a little distance, and while moving, like steel.

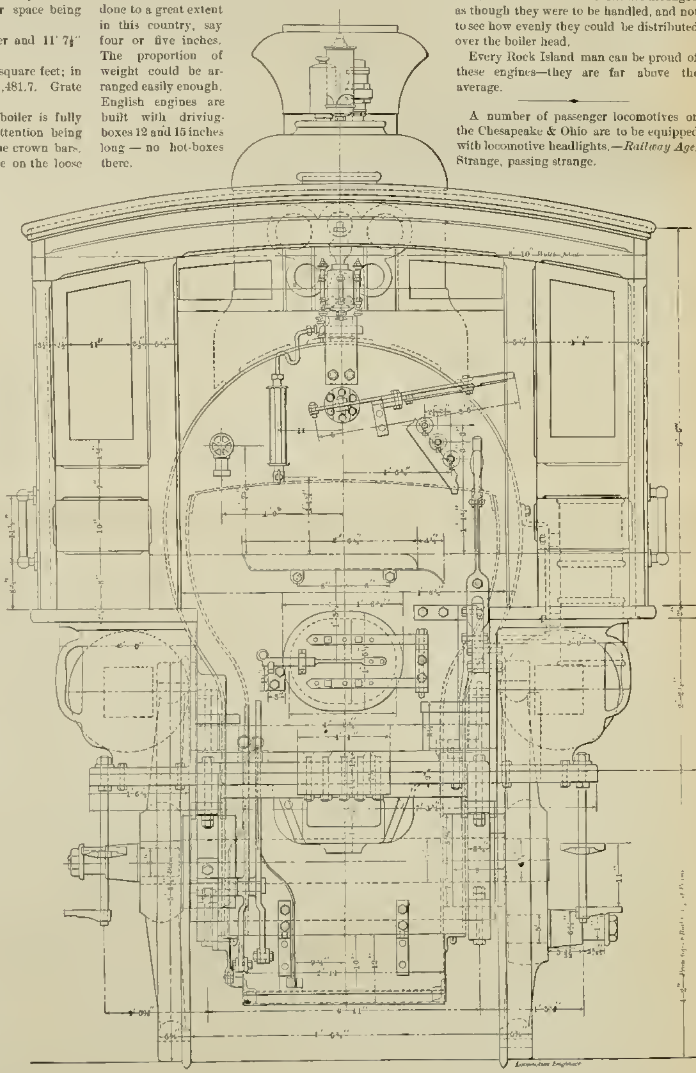
The tumbling shaft, with all its arms, is cast steel, all in one piece.

The valve rod, eccentric blades and such parts, are forgings made very neatly, and close to size, and painted, only the joints or bearings being machined.

The engine truck is a rigid one, with cast center. The pedestal jaws and the sides of the boxes are cast against chills, and the whole truck is made without machine work other than drilled holes, excepting planing of jaws and center where bolted to frames, the latter being straight pieces of iron, cut off and drilled. This truck costs less than half the usual engine truck, and has given first-class service here for years.

The engine is fitted with the Westinghouse automatic air-brakes, and has a vacuum driver brake—this is the only point we see to criticise. We believe it would be better and safer to use a driver brake operated by air and used in service stops with the train brake. The manner of fastening the safety chain to deck casting instead of tail-piece is unusual and has advantages.

Driving-boxes, 8"x9", are above the average in size, and are a step in the right direction. The box is extended in from the center of the frame slightly, and we fail to see any very good reason why this should not be done to a great extent in this country, say four or five inches. The proportion of weight could be arranged easily enough. English engines are built with driving-boxes 12 and 15 inches long — no hot-boxes there.



REAR VIEW.

The details of the rods, showing their design and finish, will be published next month.

The valve travel is 5½"; outside lap, 1", and inside lap, 1/16". The ports are 1¼"x17", the exhaust port being 2½".

The valve is of the Allen or "trick" port style, and is balanced by two round rings on top working against a balance plate, much the same as the Richardson. We never saw any ring packing that kept tight very long, but this is new and seems to be giving satisfaction. These engines have a record of considerably more than 60 miles an hour.

These machines are black, all the paint above the running board being jet, and the bands on the jacket being of Russia iron. Rods and running gear, usually finished, are painted light gray.

The cabs are roomy and convenient. The men are made comfortable by cushioned seats and back rests, and the levers and cocks are arranged as though they were to be handled, and not to see how evenly they could be distributed over the boiler head.

Every Rock Island man can be proud of these engines—they are far above the average.

A number of passenger locomotives on the Chesapeake & Ohio are to be equipped with locomotive headlights.—*Railway Age.* Strange, passing strange.

W. H. Silverthorn, of Cleveland, Ohio, has patented a piston car jack, operated by compressed air or steam. The bottom of the cylinder, which forms the body of the jack, has a two-way cock connection, and a length of hose terminating in a standard coupling. This is coupled to the train hose, and the pressure used to lift the car or box. For quickly changing brasses or packing boxes, this plan seems to have several points in its favor, not the least of which is the saving of time.

On the Foot-plate in the Argentine Republic.

The following communication from a fireman on the Caledonian Railway, in Scotland, to the *Railway Herald*, of London, may be of interest to some North American railroaders with the South American fever. His description of unfenced roads sounds as if he might have been over some of our own western lines.

"Having heard such good accounts of the Argentine Republic, I resolved to go there, and sailed from Southampton on the 18th of February, 1889, in company with seven other Midland men.

"We arrived in Buenos Ayres on March 14, after a splendid passage. I was engaged by the Great Southern Railway the next day, to start firing at $56 per month. The line extends south 450 miles, 425 miles of it is single line, worked on the ticket system, the movements of the trains being worked by one man at the head station in Buenos Ayres.

"The station wires to headquarters for permission to allow a train to proceed to the next station, and so on, so that there cannot be any mistakes made.

"My first trip, outside, was on a passenger train, 106 miles for the day's work, which, I can assure my fellow-firemen, is quite enough under the tropical sun. The heat is intense during the hot weather. The engines are fitted with a 'scum cock,' which must be open half the journey, on account of the bad water, which ruins the boilers very soon.

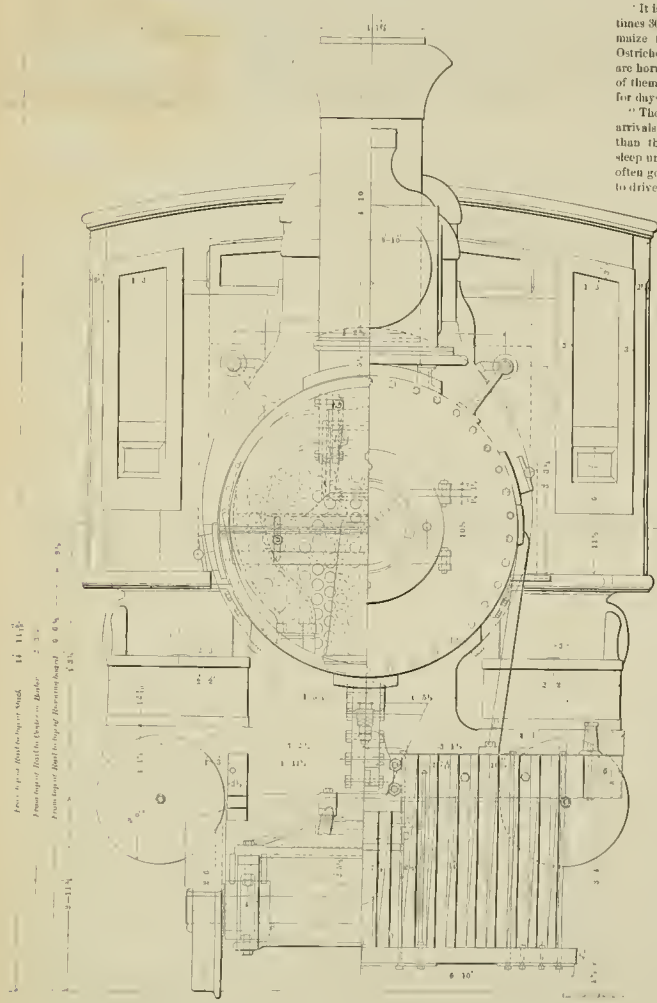
"The country is flat, and the herds of half-wild cattle, wandering all over the plains, stray on the lines, which are not properly fenced in. On my first trip, a horse went completely under the cow-catcher, scaring me very much. I have seen 16 horses dead and dying which had been knocked over by heavy passenger trains, all within 300 yards from the first to last, during the night. It is pitiful to see cattle by the line for days, dying by inches, frightened by an approaching train, and trying to get up, with both hind legs broken, sometimes hanging by a shred of skin, and walking on the stumps till they fall exhausted. The natives just take the hide and leave the carcase, which lies rotting for weeks, unless eaten by eagles or dogs, which are numerous on the plains.

"One sees some curious dwelling houses of the half-breed Indians, made of hides, stretched and dried in the sun, likewise others of dried dung.

"It is a beautiful sight to see the parrots, sometimes 300 or 400 together, when they rise from a maize field, when the sun is shining on them. Ostriches are numerous. The skunks, or polecats, are horribly smelling animals. If you knock one of them over by the engine, the smell will remain for days.

"The mosquitoes play the deuce with the new arrivals, on account of their blood being thicker than that of the natives. It is no use trying to sleep unless you have a curtain overhead. I have often got up during the night and have burnt waste to drive them out of the room.

"I would advise any one going out under contract to be paid in gold, as the paper dollar is only worth about 1s. 4d. I was given to understand that the dollar was worth 4s. 2d. by the Argentine Consul in England, but imagine my surprise on arrival to find that it was only 2s. 9d., and during the time I was in the country (thirteen months) it kept going lower, till it has reached its present value."



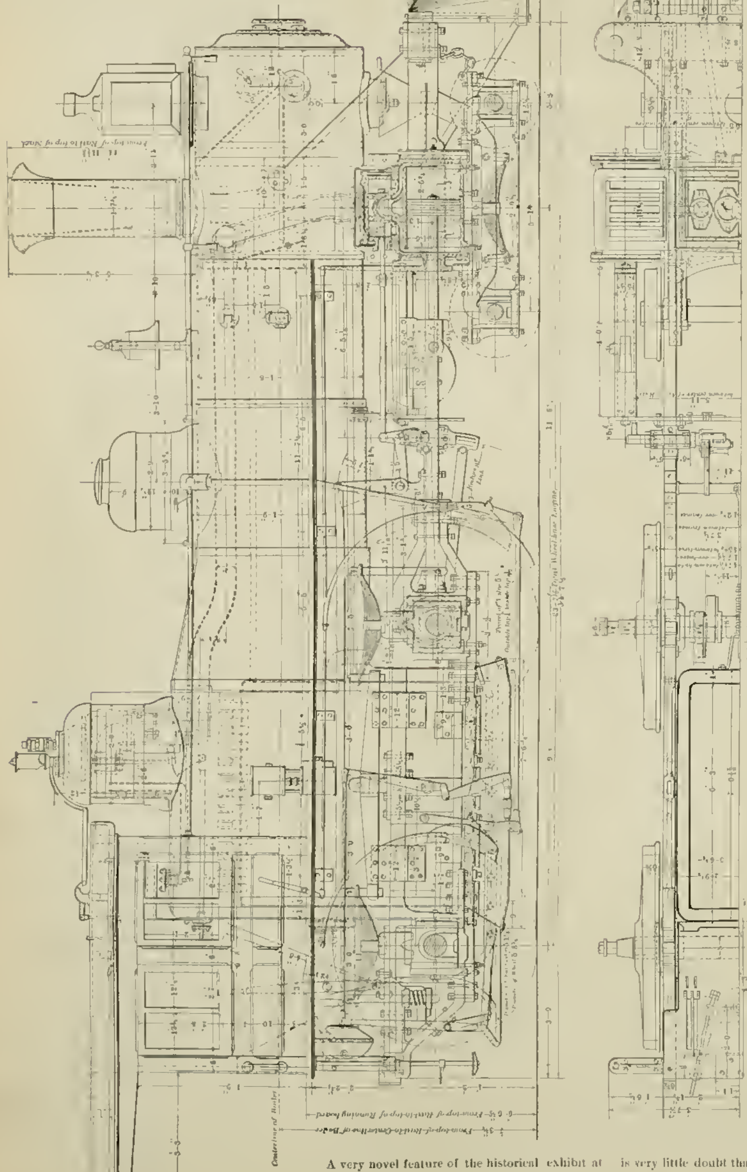
HALF FRONT, THROUGH SMOKE ARCH | HALF FRONT ELEVATION

The Lee Composite Manufacturing Company, of 29 Broadway, this city, are making and selling a paint for railroad purposes that has peculiar properties. The base is pure asphaltum, thinned and mixed with an impalpable powder of mineral slag. The slag used is from silver or lead ores and is extremely hard. Both the asphaltum and slag are mineral, impervious to water, and fire-proof. Acid does not affect them, and they will not rust. This paint is used for the tops of freight cars, and when applied, coarse slag is sprinkled upon it. This is firmly imbedded by use, is always sharp, and resists all ordinary wear, doing away with the necessity for running boards, and preventing the cinders from cutting the paint off. It is being used for cab and passenger car roofs, for engine running boards, and for roofs of roundhouses, stations, etc. It is furnished on canvas when desired, three strips just covering a car. This paint seems to be practically indestructible, is sold cheap, and is meeting with a large sale.

Harris Tabor, the well-known steam engineer, and the inventor of the Tabor indicator, has recently perfected a molding machine of novel yet simple construction. These machines are smaller than the usual molding machine, have no air-bags, loose rammers or small pieces. Ramming is done by steam. Where duplicate parts are made in large quantities they save money and produce uniform work. One of the smaller sizes of these machines is employed at the works of Samuel L. Moore & Sons, at Elizabethport, N. J., making brake shoes for the elevated road in this city. The shoes have two lugs with holes, which are cored in green sand. The work is absolutely uniform and smooth, and the holes always the same distance apart. There are but 110 flasks for this machine, so that a full day's work has never been done on it, but a laborer and a boy are doing the molding for $1 per ton. For car work these machines would be especially economical, and several are already at work on couplers and knuckles.

Don't apply your brake three or four times and then expect it to hold on the last application.

The Erie will consider itself fortunate if it can settle up the claims growing out of the butchery at Ravenna for a quarter of a million dollars. That much money would go a long way toward putting automatic block signals on the system, and would at least protect every station with automatic distance signals. This must be done. Brakemen will not go back a safe distance every time. He fails the hundredth time. When one thinks of the thousands of trains that are protected by flag daily, it is no wonder that there are accidents. The real wonder is that there are not more of them.



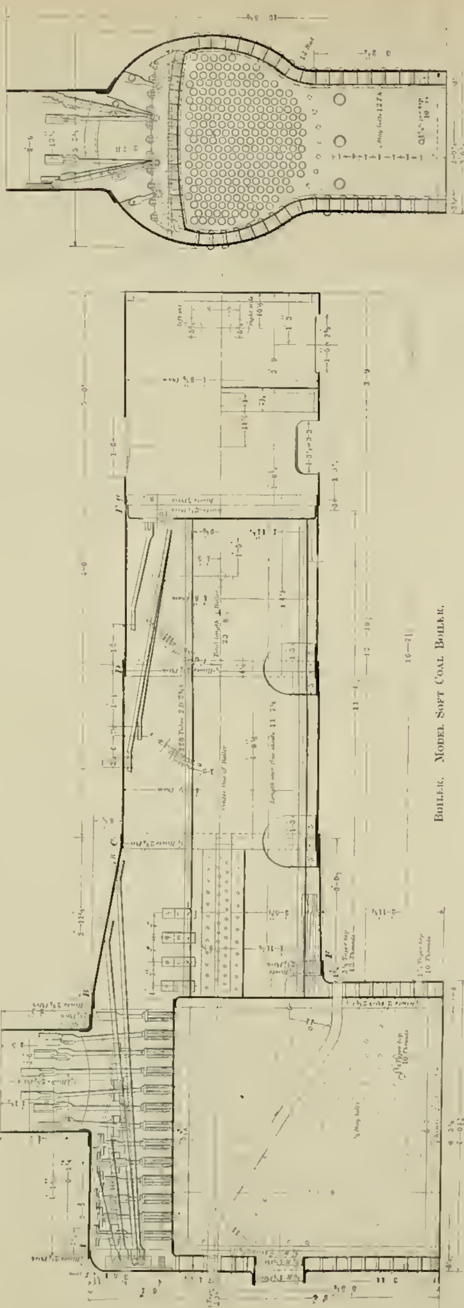
Vertical Longitudinal Section and Half Plan of Model Soft Coal Burner.

A very novel feature of the historical exhibit at the World's Exposition will be a fac-simile reproduction of the little ship "Santa Maria," in which Columbus sailed. Lieut. McCarty Little, of the United States Navy, has been detailed to go to Spain to superintend the construction of the ship. It will be manned by Spanish sailors, in the costume of the time of Columbus, and will be rigged as Columbus rigged his ship. There will be on board copies of the charts that Columbus used, and fac-similes of his nautical instruments. The crew will be of the same number, and included in it will be an Englishman and an Irishman, for it is a well-founded historical fact that William Harris, an Englishman, and Arthur Lake, an Irishman, were both members of Columbus' crew. In fact, the reproduction will be as exact as possible in every detail. The little ship will make its first appearance at the naval review in New York, where it will be saluted by the great cruisers and war ships of modern invention from all of the navies of the world. It will then be presented by the Government of Spain to the President of the United States, and will be towed through the lakes to Chicago. It is proposed that the vessel will be taken to Washington after the Exposition, and there anchored in the park south of the White House.—*Exchange.*

"Poor's Manual of Railroads" for 1891 is out, and the following is its estimate of the rolling stock in the United States: Locomotives, 32,241; passenger cars, 22,958; baggage, mail and express cars, 7,253; freight cars, 1,061,-970; total number of cars, 1,092,241. This is an increase over their last year's report of 1,200 locomotives and 11,-134 cars, but in all probability many of the returns on which they base their estimate were made from six to nine months ago. There is very little doubt that there are fully 33,000 locomotives in service at the present time. So many engines are built in small shops that it is hard to get correct figures.

The engineers and workmen on the Manchester Ship Canal had an exciting experience a few days ago, when the Mersey swept away 300 feet of a great embankment which had been constructed to divert the water at the mouth of the Shropshire Union Canal. Ten million tons of earth and masonry were washed away almost in an instant, and it was absolutely necessary to repair the damage between tides. The engineers had eight hours at their disposal, and set an army of men to work upon the construction of a new embankment of rock and clay. Railroads were laid as if by magic, and locomotives dashed through the advancing water with hundreds of truck loads of stones, refuse and gravel, at the risk of extinguishing their fires. Up to the last moment it was doubtful whether the water or human skill and energy would win the victory, but at last, when the men were almost exhausted, the baffled tide began to recede, and the embankment triumphed. It was made doubly secure before the water could get back again.—*English Exchange.*

The great accident near Paris, France, last month, by which 50 people lost their lives, and 150 were injured, was caused by the "permissive block signal system." Permissive blocking allows the signalman to admit a second train into a block after a certain lapse of time, whether the first train has cleared the block or not. These time block schemes are dangerous. They are deceptive, and offer no real security over the no block system. Absolute blocking is the only safe system, and no half-way schemes should be tolerated.



Boiler. Model Soft Coal Boiler.

New Tools at Baldwin's.

Since the Baldwin Locomotive Works have got into their new erecting shop, with its 100-ton electric crane, they can do lots more work than they used to, but improvements are constantly being made to cheapen production.

Supt. Vauclain takes one part at a time, and figures on reducing the cost of its production—in almost every case going farther, and accomplishing more than was at first attempted.

For making taper bolts for rod and frame work, they use vertical, gang, bolt cutters, six-spindle machines; the bolt is revolved by a socket wrench head in the live spindle, from above, and is turned by knives in a socket, or former, the cutting being done in a tank of oil. The bolt is roughed out in one cutter, and finished to gauge and standard taper in another. The job is a first-class one, and done by boys for forty cents per hundred bolts, some of the boys average $16 to $18 per week.

The sides of driving-boxes are finished in a rotary planer, built by Wm. Sellers & Co. The cutter head being some thirty inches in diameter, and carrying some forty tools, the head does the traveling, and the boxes stand still; there is room for twenty or more on the bed, and as the tool starts at one end and goes through, the boxes behind it can be taken down, and new ones put in their places, so that the tool finds another row ready for it just as soon as it is done with the first.

For making wedges and shoes they have a separate room, and the rough castings are finished complete by milling machines, a separate machine for each operation; one planes off the face of the shoe, another the edges, another the inside of the flanges, while a separate machine faces the flat side between flanges, one mills out the wedge bolt slot, and another does nothing but round off the corners for the fillets left between the box and the flanges. This kind of equipment would be impossible except in a place similar to this, and having, not hundreds, but thousands of them to make. Two men attend all the machines.

They are just now completing a mammoth hydraulic riveter for boiler work, this is of the usual vertical type, but has a seventeen-foot gap between the stake and ram, so that the largest boiler shell can be put together without turning it end for end.

The pattern warehouse is a mammoth building, but the science of changing patterns has been so developed that it is possible to make many different sizes of casting with one pattern by adding to or taking from it; cylinder patterns are all made so that the saddle can be raised or lowered, the spread of cylinders changed or the length altered at will. One large room is used by pattern makers who do nothing but alter patterns.

In the shop, at the time of our visit, there were seventeen compounds, most of them for foreign countries; there was one set of cylinders there for the Erie with 24' low-pressure cylinder—the largest yet built.

The charging floor of the foundry is some twenty feet above the ground, and the iron yard covers considerable space, through this yard are left tracks for iron cars, which are loaded by hand, when the car and its load are picked up bodily by a big hydraulic crane and set down on the charging floor, this has done away with all barrow-work.

In the erecting shop there were nearly completed six more of the handsome six-and-a-half foot wheel fliers for the B. & O., duplicates of the one shown in our May inset, except that they have a flange on the forward pair of driving wheels—a sensible improvement.

Mr. Vauclain has recently patented a new wrought iron piston head, made in two pieces, that go together on the rod like two pie plates, and hold the packing rings between them, they are very light and strong.

The "Teutonic," of the White Star line, has beaten the record of her sistership, the "Majestic." She arrived in New York August 18, having made the passage in five days, sixteen hours and thirty-one minutes. This is one hour and thirty-seven minutes better than the "Majestic's" time. At sea a day is reckoned as from noon to noon, and the "Teutonic" covered 517 miles in one day.

Jim Skeevers' Object Lessons.

Skeevers' fireman, Billy, has been "set up" a fortnight now, and the Old Man put Mike Kelly on with Skeevers.

It's Mike's next turn to do the "touch the button, the fireman does the rest" act, and the Old Man thinks Skeevers a good runner to graduate the boys.

Skeevers is no hog, he knows that Billy is the best fireman on the road, and does lots of *his* work, and that the next fellow will make it harder for him, but he's been thinking of Bill some, and rejoices in his promotion—he has an interest in his success.

Mike was born with a constitution that could stand worlds of rest, and probably he also inherited some of his propensity for never going to bed until the last cat is hung, and then hating to keep awake the next day.

Mike, in common with other mortals, must suffer the ills of his inheritance, but Mike, and all the rest of us, suffer more from the desires, habits and practices that environment has established than from inheritance—or anything else.

Mike didn't get the right kind of an engineer to start with, so now, after firing four years, Mike knows a lot of things about locomotives that is not so, and has learned a lot of things that he must unlearn, and formed a lot of habits that must be broken.

Perhaps the Old Man knew this, and put the job onto Skeevers, and blames Mike and his first engineer; but why didn't the Old Man tumble to all this three years ago, before Mike's crooked habits got "set," so to speak. These Old Men make lots of curious engineers out of firemen of their own selection, and then go off and kick about them—but that's nothing to do with Skeevers and Mike.

Mike's worst habit, as it struck Skeevers, was sleeping on the engine. Skeevers is down on that, he knows that it is dead wrong, to begin with, and Skeevers carries a big scar that he got one night, a long while ago, when he was firing for a man who slept on duty; the man has slept ever since—in a graveyard. That was an object lesson to Skeevers, and Skeevers maintains that one good object lesson is worth more than two books, or four or five hundred "tellings." So Skeevers concluded to give Mike a few object lessons on sleep, and how *not* to do it on an engine.

Skeevers pulls fast freight, generally having enough refrigerator cars or fruiters ahead to handle the train with air, the division is long and hilly, some places the train will run for eighteen or twenty miles.

The first trip out Mike attended to his duties pretty well, but got dozy on the long stretches between fires, but the second trip he went fast asleep, and Skeevers had to wake him up to get over Waxem hill.

The next night they had to double out, and as soon as they pitched over for a ten-mile run, Mike fixed up his fire a little, and sat down.

"Mike," said Skeevers, "don't let me forget, I have orders not to pass Ford's without orders—don't let me go to sleep."

"All right, Skeevers," said Mike, "where do you meet three?"

"At Ford's," said Skeevers.

Mike closed his eyes directly, just to rest 'em a little; then he looked around, owl fashion, kind of thought he saw his best girl ahead of the engine, nodded to her, made a profound bow, and—was off. The engine? No, no, off to sleep—"pounding his ear," Mike calls it.

Skeevers sailed right by Ford's, and took the siding at Sand Creek, all "unbeknownst" to Mike.

When "three" thundered by Mike jumped up, put in a fire, and asked Skeevers if he had his orders yet.

"What orders," asked Skeevers.

"That 'do not' at Ford's."

"We're by Ford's, and I didn't get the orders," said Skeevers, in an awed tone of voice, "it's a wonder we didn't hit three."

"You're in for it Skeevers, I guess."

"So are you."

"Not much, I'm no bold engineer."

"I told you to look out, and not let me go to sleep, I believe you were asleep yourself."

"No, sir, I was drowsy, but not asleep."

"Not asleep? well, you had your eyes shut."

"Yes, but it wa'n't sleep."

"What was you thinking about when we passed Ford's?"

"Nothin'."

"Well, Mike, if you shut your eyes and stop thinking, it comes nearer being sleep than anything I know of. We'll probably get fired, or get ninety days for this."

Mike was wide awake the rest of the way in, but Skeevers appeared glum and downhearted. The head gafter came over near town, and Mike told him about it, and the gafter said they had orders to meet three at Sand Creek, and no "do not" at Ford's. Mike accused Skeevers of "playing smart," and Skeevers asked Mike how different it would have been had the case been genuine.

A few trips later Mike started a snooze in good shape, and Skeevers quietly let the 48 drift against a slight grade and stop, steam low, in twenty minutes the conductor came over, swung up into the gangway, and asked Skeevers what was the matter with the 48.

"Nothin' at all," said Skeevers, "nothin' at all, but the fireman is worn out for sleep, and has laid off, I have no fireman."

Mike was awake then, and heard the talk.

"I ain't paid for firing or keeping the fireman on duty," continued Skeevers, "if Mike wants to lay off it's his business, and the Old Man's—not mine. I won't run without a fireman, though—not a mile."

The conductor consulted his watch.

"Can't get to Sand Creek for three now, what'll I say was the cause of delay?"

"No fireman," said Skeevers.

The conductor went back over the train, and Mike nursed his wrath awhile, and then turned loose.

"Skinny Skeevers, how long you goin' to work this racket, and make such a darned fuss about a man's dozin' a little, and reportin' every little thing?"

"Just as long as you sleep on duty, Mike," said Skeevers, "I won't run a rod with you when you are asleep; I will stop just as quick as you shut your eyes, let the circumstances be what they may. I shall not let the conductors lay any such delay to bad coal or leaky flues. It must all be charged up to 'no fireman.' If you stay on the road you will soon be running an engine here, and if you sleep on duty now you will then, and it will all end in your killing yourself, and, perhaps, some one else, very likely me. If you stay on the road, and on this engine, I will break you of sleeping—you are liable to be fired any day for good cause, however."

Mike kicked some, all to himself, but he is keeping awake pretty well, and if Skeevers just lets a little air out of the brake valve now, Mike will straighten up and say:

"Oh, I ain't asleep, Skinny, bet your neck I'm all right."

Skeevers says it will take six months to make a permanent cure, and remove the tendency of fatal symptoms to return, but Skeevers says he'll fetch him, and still has an abiding faith in object lessons.

A Graphic Method of Finding the Length of Radius Bar for Pony Trucks.

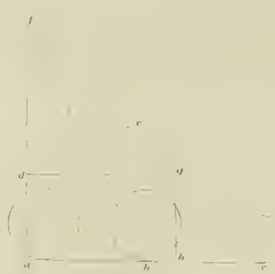
The object of the radius bar is to keep the wheels of the pony or two-wheeled truck radial with any curve that the engine has to take.

There has been a great deal written on this subject, and the subject has been much obscured by formulæ, but the matter is not so difficult after all.

The length of the radius bar must bear a fixed relation to the total rigid wheel base of the engine, and to the distance ahead of this rigid wheel base that it is desirable to run the truck.

From the advance sheets of an exhaustive work on locomotives, "Modern Locomotive Construction," by J. G. A. Meyer, we condense the following graphical method of finding this length.

Draw a horizontal line half the length of the rigid wheel base b to a, and the distance from front flanged driver to pony truck wheel b to c. Erect a perpendicular at the center of rigid wheel base, draw a line from the pony truck point at c to the perpendicular at an angle of 45°. This completes a triangle with two equal sides. Now draw a line from the top of the triangle through the forward point of rigid wheel base at b. Bisect this line at right angles, forming line d e. From the point of intersection d draw a horizontal line parallel to the base line, and from the intersection of this line with the line e f draw a perpendicular to the base line at g. The length of this line g h, or the length of the base line from its intersection to the pony truck wheel h c, is the correct length of radius bar, and this bar will keep the pony truck wheels radial with any curve.



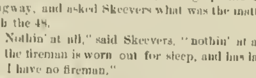
Length of Radius Bar.

In practice, it is customary to make the length of the bar about 10 per cent. less than the theoretical length, to insure the flange against climbing the rail.

Forging a Frame.

Mr. Stephen Uren, general foreman of the forge and rolling-mill of the Sacramento shops of the S. P. road, makes a locomotive frame in a way of his own, and gets excellent results.

He forges the upper and lower rail separately, welding on or drawing out parts of the pedestals on each piece, as shown in Sketch 1. These pieces are placed together and held by clamps while being welded together. The ends of the jaws and braces are scarfed sideways on each side, so that they meet only at the points. Triangular pieces are then laid into the depressions on each side, a welding heat taken, and the whole frame welded up entirely by side blows from a steam hammer. This done, the frame is relieved of the clamps, and can then be finished and straightened by lighter work. This form of weld is said to be much stronger and easier to make than plain side scarfs, while all frame makers of experience condemn the "jump" weld.



Forging a Frame

Railroad operators are daily quitting their positions to accept jobs as firemen, brakemen or switchmen. Even a commercial operator in this city recently resigned a comparatively good position for a chance to shovel coal on a locomotive, because it pays better. Organization has placed the salary of the unskilled workman far above that of the skilled workman.—*The Telegrapher*. Organization has placed the pay of firemen above operators, but if *The Telegrapher* thinks that firing a locomotive is unskilled coal shoveling, it is simply showing that it doesn't know what it is talking about.

The great tunnel under the Hudson River is nearly completed, and it is expected that trains will run from New Jersey direct to New York in the near future.

Correspondence

Bad Practices.

Editor The Locomotive Engineer:

Inasmuch as your sprightly paper is destined to develop a better feeling on the part of your readers among themselves, and with regard to their duties as employes, and will doubtless take its place as a leader of thought among those men, permit me to suggest that they be given, through your columns, a good sound lecture on the folly and evil results of reversing and slipping their engines, and the too constant use of their blow-off valve.

The young men I examine for promotion seem, as a rule, to have no intelligent ideas on these important matters.

F. S. GANNON, Gen'l Supt S. I. R. T. Ry.

New York.

[We have noticed that the habit of reversing the engine to avoid running by stations, etc., is quite common on the rapid transit lines in and around New York. In this class of service the plain vacuum brake is used, and driving brakes employed, and reversing with the brake on, means sliding the driving wheels in almost every case. This practice comes from the old days of hand-brakes, and of that later but not far distant decade when it was believed that driving brakes ruined an engine anyway. Have brakes on every wheel possible, keep the apparatus in condition to perform its important duty *instanter*, and don't take any chances fooling with the reverse lever.]

The Right Spirit—Who Knows About Water-brakes?

Editor The Locomotive Engineer:

I have been wanting to write to THE LOCOMOTIVE ENGINEER for some pointers for a long time, but have not done so on account of not wishing to show my ignorance. But I have come to the conclusion that I had better show it now than five years hence—so here goes.

I should like to ask information of L. C. Hitchcock about giving an engine lead. On page twenty-five of the February number of THE LOCOMOTIVE ENGINEER he says: "The requisite amount of lead can now be given the engine by moving the eccentrics on the shaft," but he does not give any rule for so doing. I presume he takes it for granted we ought to know how. I think his article on setting valves the plainest I have ever read, and it was a great help to me when I went to work to square up the old hog I have been driving up the mountain for several months. After I had gotten my blades all the proper length, I found she had $\frac{3}{32}$" lead in forward motion on right side, and was even, blind, on left. And in back motion she had $\frac{1}{16}$" lead on left, and $\frac{3}{32}$" on right side. Then I set about to give her the proper lead. And here is where I got stuck. How was I to get at the back eccentric set-screws? The only way that I could see was to take down the go ahead eccentric or strap, and, if I did either, how was I to tell how much to move the eccentric? The result was I did not get at them. As there was only $\frac{1}{32}$" difference, and that in the back motion, I concluded to let it go. I then put reverse lever in extreme forward notch, pinched engine ahead, caught front center, and had helper advance forward eccentric until valve tram marked $\frac{1}{16}$ in front of port closing line, and then did left side the same way. But what I want to know is how to get at the back eccentrics without taking down the forward eccentrics or straps, and, if I take them down, how am I to tell when I have moved the eccentric the proper distance? Well, I had the old mill square in the forward motion and was satisfied. If there is anything that will give me "the jerks," it is a lame or a slippery engine.

I would like to know something concerning the water brake. I have been using it for almost three years, but have much to learn yet. The McQueen engines here on the C. M. Ry. have single nozzles, extension fronts, and straight stacks. The Baldwins, double nozzles. While using the water-brake on the Baldwins, you will think your cylinders are not getting any water, when all at once she will throw a bucketful out of the stack, and it will come out of the cylinder cocks so strong you will think you are about to knock a head out. Then she will stop throwing it just as though you had shut the water off. The McQueens are not so bad in this respect; but I have run only one that I thought handled her water about right. I could let her down the hill (twenty-five miles) without throwing any water over her jacket, and still keep plenty in her cylinders. There is another that is as bad, if not worse than the Baldwins. She will squirt it out her cylinder cocks, and throw it out the stack, then she will stop, and her valves get so dry that if you lift reverse lever latch she will jerk you off the seat. I have talked with several on this subject, but they don't seem to know any more about it than I. Will some of the readers of THE LOCOMOTIVE ENGINEER enlighten me?

Aspen Junction, Colo. J. W. KAEFUS.

Sight-feed Glass Phenomena.

Editor The Locomotive Engineer:

I hereby send you two lubricator glasses taken from a No. 8 Nathan double sight-feed lubricator after about seven weeks' usage. As you will see,

one end is eaten down to $\frac{1}{16}$" smaller than the other parts of the glass. When these glasses were put in they were the same size along from one end to the other, and now they are reduced $\frac{1}{16}$ of an inch for the length of $\frac{3}{4}$" on the upper end of the glasses.

Now why is it that the upper end of the glasses is wasted away while the lower end is still its original size? There is only a rubber gasket on each end, and if this is the cause why does it not eat both ends alike?

In this manner most of the glasses are broken, and only by the Nathan lubricator, the Detroit lubricator has not yet been known to break the glasses like this.

Vacuum oil is used in the oil cup. I have been told that there are only a few acids that will eat glass, and they are not commonly found. I hope you will work it up for the boys.

Mt. Savage, Md. E. G. R.

[This is the second case we have heard of where the sight feed glasses of a Nathan cup cut out, while the same kind of glasses using the same gaskets on other cups were not affected. The glasses sent by this correspondent are on our desk, and the outside has the appearance of having been eaten with acid or reduced by a sand blast. Most water line glasses are cut out at the top, but on the inside. Who can explain this trouble?]

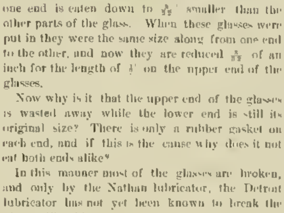


Fig. 1

Fig. 2.

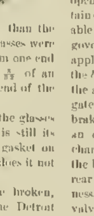


Fig. 3.

Some Faults in Machine Tools.

Editor The Locomotive Engineer:

I want to say a word about defects in machine tools and machine shop fixtures. Why is it that tool builders will adhere to the bevel ways, for slide rest in lathes, and the crossbeam and head, in shapers and planers? The bevel is not as solid in general practice on any machine as the form shown in Fig. 2. If a person will watch a lathe slide rest, or planer head, while cutting over irregular surfaces, it will be seen there is a sliding motion on the bevel, and no amount of metal will prevent it. It makes no difference how thick a gib we may use in a slide rest, as shown in Fig. 1, the points of the set-screws must take the thrust which is a very small bearing. In Fig. 2, with taper gibs 1, 2, 3, we have a solidity which no other shape will give us. Fig. 3 shows one of the worst forms for a crossbeam, they cannot be made without springing to the cut of the tool. The feed gear in shapers is too weak, more particularly that type where the vertical feed is produced by moving the crossbeam up or down, which, taken together with its load and the thrust of the tool, is too much for the feed gear, and it soon gives out. Some reputable builder will use a screw only an inch in diameter to support the load, when in most cases an eighth-inch steel pin transmits the power to move or overcome the weight of crossbeam, chuck, work, thrust of tool and friction of slides. Such construction shows bad judgment, to say the least. The feed dogs, or ratchets, on most planers are only traps to injure the operator. They should be constructed so they could be thrown in or out of gear while in motion, and yet be safe. The old wrought iron vise, and most of these so-called lightning grip vises, have no place in a modern machine shop. They are no good for variety work.

Corry, Pa. W. DE SANNO.

Danger in Testing Brakes from Rear of Train.

Editor The Locomotive Engineer:

I read with no little interest, nor less apprehension, in your July number, of the growing custom on the part of trainmen of testing air on trains by opening the rear train pipe stop-cock. Under certain conditions, this practice might seem unobjectionable, but I believe that one unvarying rule should govern in this matter, *i. e.*, to require brakes to be applied by the engineer, through the agency of the *brake valve*. The engineer is the brakeman on the air brake train, and he cannot afford to delegate such an important duty as the testing of the brakes to some one at the rear of the train. When an engine has coupled to a train not previously charged with air, the application and release of the brakes attending the opening and closing of the rear stop-cock indicate with reasonable conclusiveness that the train line from the engineer's brake valve to the rear stop-cock is charged, and intact; now let us change the conditions a little, suppose at some station the engine cuts off—a very common happening—to get coal or water, or both, it returns in a few minutes and couples to its already charged train, pressure reduced a trifle perhaps by the leaks common to the average freight train. The brakeman in testing his air opens the rear stop-cock, discharges part of the air in the train pipe, hears a number of brakes next to him go on, throws the handle back into its original position, when the escaping air is suddenly arrested, causing the pressure at the rear end of the train pipe to run up and release the brakes on several of the rear cars, the brakeman is under the impression that he has made an effective test of the air, and, if the head man has "cut in" the engine when coupling up, he will not know any better, but the results shown above can be gotten without the engine being cut into the train line at all. Your subscriber has witnessed such practices, and found it his duty to inveigh against them.

A better plan, and one which I observe is followed on some of our roads, is to require the employe acting with the engineer in making a test of the brakes, to start from the engine when the engineer makes the discharge of air from the train pipe, and pass back along the train, noting that the brakes have been properly applied, signaling the engineer to that effect when the rear end has been reached, then to walk back to the engine to see that the release takes place the same as application.

In view of the grave responsibility involved, too much care cannot be given the matter of testing and handling of air brakes, as with the best of care there are agencies at work that from time to time produce failures, and the casualties that follow often in their train. A very interesting list of such failures could be made from the experience of those engaged in operating air-brakes. As indicative of the fallacy of the rear stop-cock test, let me state an incident narrated to me by Mr. W.

R. Scott, one of the traveling engineers of the A., T. & S. F. system, a young man of rare good sense and judgment, with a splendid development of the perceptives and reflectives, and who, by the way, owes his advancement to his present responsible position to the possession of the above desirable qualities. Mr. Scott started on a trip out of one of the terminals of the middle division on this system, with a train of 30 cars, 25 of which were equipped with the Westinghouse automatic air-brake, properly charged, and in apparent good condition. On account of the inspector being engaged at a distant part of the yard, and to save time, the rear brakeman had made the air test by opening the stop-cock on the last car of the train. As all the cars between him and the engine were "cut in," the application of the brakes on quite a number of those next to him, and their release after the cock was closed, satisfied the brakeman as to the efficiency of the test. Mr. Scott, however, had no faith in this style of brake test, and proposed having it done in the proper manner; he accordingly discharged enough air through the brake valve to insure the application, and requested the brakeman to go back along the train, inspect brakes, and advise him if all were O. K. This was done, and the engineer notified by signal that they were all right. Results proved that the brakeman, disgusted at the engineer's unnecessary (?) caution, had simply walked along the train to gratify him, paying no attention to the brakes, and reaching the rear end had signaled him that they were all right. Here the experience and good judgment of the engineer came to his aid. He had noticed that the reduction on the gauge was too rapid, when making the discharge from the brake valve, to come from a train pipe 25 cars in length, and not wanting to wait longer, he decided to go, resolving mentally, however, to use extra caution in making his first stop, which was at a junction. When that point was reached he discovered very quickly, when trying to check the speed of his train, that his suspicions were well grounded, and that he had not the number of brakes operative stated by the brakeman. Having side tracked for an express train, he at once began an investigation of the trouble. The fireman was requested to apply the air, when Mr. Scott started back along the train, counting the cars, and finding that he had seven with brakes applied, and that while all the others were charged and "cut in," no application had taken place back of the seventh car. The brakeman, arriving at this juncture, was asked to explain why he had said that there were 25 cars with brakes working, when the test showed but seven. That gentleman, who had acted in good faith, requested Mr Scott to have the brakes released, and remain where he was, and he would show him that the brakes would apply through the entire train. This being done, the brakeman walked to the rear end, opened the stop-cock, and lo, every one of the 25 brakes applied with a snap. Here we see that while all the brakes could be applied from the rear end, but a small part of them were effective when the train pipe pressure was reduced at the brake valve.

In your experience as a practical manipulator of air-brakes, you have doubtless met with enginemen who would have promptly, and without investigation, relegated the phenomenon here witnessed to that realm of mystery in which some are wont to enshroud many of the unusual manifestations met with in air brake practice; not so with the man pulling this train; he had a habit of reasoning from cause to effect, and *vice versa*, and he at once began a search for the cause of the trouble. This in due time was discovered to be a plug of waste in the train pipe, behind the strainer, which drew into and stopped it up when the train pipe pressure was reduced from the front end, preventing any reduction back of that point, but when the air was exhausted from the train pipe through the rear stop-cock, the plug was drawn away from the strainer, allowing a uniform reduction to be made the full length of the train pipe, and the consequent application of the brakes. This was, of course, a very unexpected occurrence, but it is the recorded experience of most people that it is the unexpected that generally happens.

Moral: In testing air-brakes on trains made up and ready for the road, require train pipe pressure reduced through the engineer's brake valve, and always by the engineer in charge. T. Paxton.

Nickerson, Kan.

Packing Air-pumps.

Editor The Locomotive Engineer:

I am very glad that some one will take the trouble to discuss air-brakes in your columns. It has until a few years ago been made a mystery of by those who handled it, and only by debating such questions can information be obtained of others' practices. As to the lift of air valves, would state that I believe that the upper receiving valve preferably, or lower discharge valve, should have a little less lift than its mate, to balance the weight of piston and keep it from knocking on down stroke.

I assumed that the hot pumps under consideration had been put in the order that Brother Smith mentions as near as possible, and will state that with a poor conducting surface, such pumps can be red-hot, and will ask why pumps will get hot under bad management, and get cool again without oil while locomotive is standing, as sometimes occurs if his theory were right, as with oil burned his pump would churn worse than ever.

Any one interested on this subject can gain much information by sending 50 cents to *The Engineering News* Publishing Company, Tribune Building, New York City, for "Compressed Air Production," by William L. Saunders. I believe it to be one of the greatest of helps to an air man.

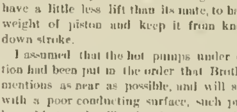


Fig. 2.

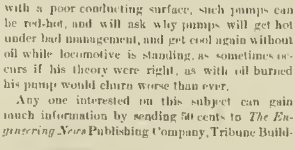
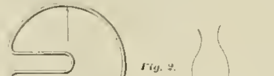


Fig. 1.



Dirt guard for front of Pump Fig. 3.

I do not wish to be understood as saying that no water will deposit at all times, but that more is deposited under conditions mentioned, and that it deposits only what is in the air, and that if there is more water in the air it will deposit in greater quantities, or, perhaps, enough to give trouble, which might be avoided if condition of air were known. Also that on some days air released from trains will carry out more water than at other times, as may be seen by opening cocks on trains for a few days, and noting results.

I wish to make a proposition to my brothers of the pipe wrench and burnt finger fraternity, if the editor is willing. I will state my way of doing something, and will invite criticism, and wish to be handled without gloves. Let some other air man tell what he knows about some job, and awaken a discussion—by which I, for one, hope to be greatly benefited—and to start will tell how I pack an air-pump.

I take an old sprinkler hose, if I can't get a new one, and when I have time I begin at one end, and cut it in a square strip round the hose till I have it all cut. On my spanner wrench I have marked the length required to go once round the piston rod. I cut my rubber this length, and untwist asbestos wick, and wrap my rubber with it, this will just fit the stuffing-box, and I lay it by till I have to pack a pump. Then I unscrew the bottom nut, start the pump slow, and blow out the old packing. I have a piece of brass spring wire $\frac{3}{16}$" diameter, bent as in Fig. 1. I hook the small end under the lower gland and spanner nut, and the open part over the top one, and proceed to pack the air part without the burning or cussing usually indulged in. I oil my packing well, and break joints, usually getting in three pieces, and do the top one the same. This, if not screwed down too tight, will not harden, and by occasionally adding a piece will last almost indefinitely; at least I have them now running on main line that were packed two years ago, and are good yet.

The piston rods wear smooth without scoring; there is not so much friction as on any other kind that I have used, and in consequence the pumps do not work so hard, and last longer. The best swab that I have seen is made as in Fig. 2, of hammered sheet brass, and wrapped with candle wick. An oiler can be put in the finger loop if thought necessary. I then have a guard made of Russia iron, with the ends bent to catch on the rear bolts of pump, as shown in Fig. 3, and wide enough to cover center piece; this will keep out sparks, lasts well, makes a very neat job, and gives very little trouble. When I have a pump that I am afraid of getting hot, I have smaller piston guards that just fit spanner nuts, and give more surface for conducting away heat. This is the best practice that I know of, can I learn of a better?

Roanoke, Va. George Holmes.

A Breakdown Puzzle.

Editor The Locomotive Engineer:

Once in a while you publish air-pump puzzles for air-pump doctors, but there are but a few of them to guess, so I am going to start the ball rolling among the boys by propounding a breakdown question. This will help those studying for promotion to think, and I think would be an interesting feature of the paper. The trouble with the gang is that they are afraid to guess for fear of going wrong. But for the puzzle:

Alex Cunningham was running an old eight-wheeler on the Mobile & Ohio a few years ago, and all at once she commenced to limp.

"Three legs," said Alex. to the fireman, "She's slipped an eccentric."

He stopped, got down and examined her carefully, but her eccentrics were in place, and her valve motion all right.

"It must be a broken valve yoke," mused Alex., so he got up and tried her.

Steam came out of the right back cylinder cock only, and Alex. took up the right chest cover, only to find the valve, yoke and ports all right.

He got up to move her to hunt farther, and she seemed to go all right, and he gradually increased speed and finally ran in.

The machinists took up both chests, looked into both cylinders, the front end and everything else, and swore she was all right, and Alex made another trip with his three legged pet.

He reported the right side examined again, and they found the trouble at once. What was it?

Philadelphia, Pa. Traveling Engineer.

[Studying practical questions like these will do every engineman good; he will think. Try an answer.]

Marks Reports the Franklin Institute.

Editor The Locomotive Engineer:

I see by yoor August number thet yu kort onto ther great skeem of Tom Shaw, which he tried ter spring at ther Master Mekaniks Convention about ther wonderful kompound goin up hill. Ef yu had been at ther last meetin of ther institoot yu wuld not wonder at anything they say.

Yu jest orter herd ther report as read by ther chairman, he of ther flowin whiskers and ther King-Solomon-I-am-ther-wisest-man expression of his voice, sorter komes down ter our level just ter akomodate us, and tell us a leetle of all his store of knowledge, particularly about kompound engines. Yu know him. Well, he sailed inter ther kompound buzines in great shape, and ther report sounded nice, even if we all knew (includin ther chairman) thet it wuz chuck full of statements that wuzn't so and never wuz and never will be.

He told us how, by havin four cylinders, yu could build ther engin narrower than if yu only had two, and proved it by diagrams drawn from natur. it wuz clear that ther two cylinders wuld take up ther most room. Ef yu don't believe it, just ask ther chairman, Mr. S. Lloyd Wiegand, Patent Attorney, etc., and he kan explain it to yu so yu kan't help but see it.

Then with the four-cylinder kompound yu kan kome home on one side if ther other side breaks down on the road. With ther others yu kan't, because it hasn't got but one cylinder left, and it takes two to run home—at least so ther chairman says, and he knows, ef he didn t, he wouldn't be on ther komity, because only ther railroad experts is on that. We used ter think that with ther old simple engins we could come home on one side, but sence hearin this report we hav kum to ther konklusion that we never did come home one sided, tho we thot we did then—jest dreamin, I guess—fer the chairman says it kan't be did, and of course he knows.

Then, too, ther Webb engin was supposed ter be able ter run in with any one of her three cylinders, ther other two bein disabled, but since hearin this report of the komity we know that was only a dream or fancy, too Strange how much a man kan learn from just hearin a report of this kind read, and not only read, but explained in sech an able manner by ther aforementioned chairman, yu orter heard it. If ther reports was fer sale it would pay ther railroad companies ter buy a few hundred and giv ter ther best engineers, for it givs sum valuable information; but I think ther reports must be scarce, for they have not been sent ter ther members of ther komity, as wuz ordered at ther meetin. But then, of course, all such orders are at ther option of ther chairman, who steered this report thro. It takes a good lot of steerin ter get a thing of such momentous valu thro without havin some one who isn't up to ther high grade of ther art, kick It says the report wuz unanamous, but I guess it means unanamous when ther chairman wuz alone.

If yu could make sum arrangment with this man fer editin part of your paper, I think it would giv it a good start in ther higher branches of railroadin, *i. e.*, savin fuel, on paper, and squeezin ther engins so as ter go in narrow places. Ther rule is this, ter make an engin narrower: "Add two cylinders, and pay a royalty fer usin the patent uv this one."

It must not be understood that this wuz a medal fer bein ther best engin, tho ther award duz say so, fer the chairman said thet it "wuz fer a departure from existing practice," and we suppose this means ther act uv squeezin by addin cylinders. That is a departure, surely. Ther medal orter be divided inter two pieces, fer ther first half belongs ter ther engin thet has been changed inter a simple one by ther B. & O., and the other half ter the one which Mr. Shaw described so accurately at ther konvention Don't know what they will do about splittin ther medal, but it orter be dun.

If yu hav anything novel, and a "departure from existin practice," jest bring it before this komity and get ther medal, and get ther chairman to explain it fer yu. He can do it better than yu kan. R. E. MARKS

Camden, N. J.

Suggestions for a Front End.

Editor The Locomotive Engineer:

The extended smoke-box was designed to catch and carry cinders, but you will go a long way and hunt a long time before you will find one that does that and lets the engine steam fairly well at the same time The successful ones are so arranged that they throw out 90 per cent of the cinders; then they steam

I do not believe that there will be many practical railroad officials who will dispute me when I say that the law requiring spark arresters, cones, netting, etc., is directly responsible for two-thirds of the fires laid to locomotives.

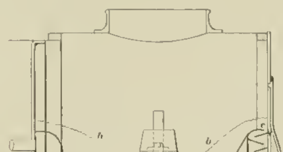
Every impediment put in the way of a free, easy exhaust, calls for a sharper blast to force the gases past or through the obstruction, the nozzles are contracted, the blast increased, and more fire is drawn through the tubes, and forced through the netting and stack

I have experimented enough to satisfy myself beyond all doubt that a straight open stack on a short front, entirely free from netting or other obstruction, will admit at once of opening the nozzle, and insure a free steamer and a stronger working engine without throwing fire

The extension arch is heavy in a place where lightness is desirable—on the truck. It is harder to keep tight than a short front; it costs more first, and more to keep up, and is very dangerous to strike stock with.

What is wanted is some device that will kill such cinders as may be drawn through the flues, and then throw them out, dead. Suppose we take a short front, put in the usual adjustable diaphragm, and a course netting, as shown at *b b*, then put in a partition sheet as shown at *a a*, making the bottom chamber *d* comparatively tight? The action of the exhaust will carry the cinders, too big or too heavy to go through the netting, up the incline and into the orifice *c*, where they can fall by gravity or be drawn down the inclined shelves to *e*. They are dead long before this, and are then drawn into the pipe at *f*, and thrown out by the exhaust. This pipe is only one form, easy to make, and is something on the exhauster plan for vacuum brakes, a pipe entirely around the nozzle might be used, or any of a dozen things that would accomplish the same end.

The inclined shelves would be half on the door and half on the lower cavity, so that when the door was opened the shelves would all be exposed. This lower cavity *d* may be made in the shape of a cast-iron box, say 12 inches wide, requiring no tight joints between it and the arch.



The way I am fixed here, it would take about nine thousand fathoms of red tape and four years to get permission to try this, so I throw it out as a hint to men who are not buried quite so deep.

One of the cleanest engines in this country is the Webb engine on the P. R. R., and she has a short front, open stack, and no netting

A SOUTHERN MASTER MECHANIC.

Valve Motion Question.

Editor The Locomotive Engineer:

I would like the views of some of the readers of your valuable paper on link and eccentric motion, and would ask What becomes of the oscillatory motion of the link when the reverse lever is put in the extreme forward notch with link blocked down tight, and the back-up eccentric rod taken down, and does it practically shorten the other, or go-ahead? If so, how much and why? if not, why not?

Duluth, Minn. L. L. HOOD.

Double-seated Throttle Valves More Than Forty Years Old, Anyway.

Editor The Locomotive Engineer:

I see in this month's number there is an inquiry about the early use of the double throttle on a locomotive The first one I know anything of was put in engine Philadelphia, rebuilt by James Millholland, for the Philadelphia & Reading Railroad Company, some time during 1848 It took steam from two domes. He used the same device on all the engines he built new or rebuilt for the P & R I believe he used same style of throttle on the Baltimore & Susquehanna Railroad prior to his coming to the Reading E. J. RAUCH.

New York.

Differences of Opinion on Examinations—A Plan to Insure Flagging.

Editor The Locomotive Engineer:

It is evident that a wrong construction has been put on my article on examination. I do not claim that engineers should file their brasses, or do any of their running repairs, but I do claim that they are so much ahead if they know how to do the work, and I claim still further that a year spent in the roundhouse and back shop is worth more to the coming engineer than two years on the left-hand side of an engine.

Engineers are sometimes promoted to the grade of Division M M., and the more they know about locomotive construction the better it will be for them in their new position. I know what it is to work under Engineer M. M.'s who had never learned these things in advance. I have been compelled to do work that was wrong in theory and practice, simply because he was M. M., and I was machinist.

The examinations are all right, and must result in good to all concerned. But I still insist that there is a class of men who will learn to answer these questions, parrot-like, who will never make good engineers. I quote a man who has been firing over four years and did not know what a petticoat pipe was until the writer told him, yet he is kicking to be set up. Another party is posting up on Mr. Cushings questions, and will learn them; but he will never know the most of the parts when he sees them. The examinations will weed this class out.

I make another claim—the man who will not make a first-class fireman after two years on regular duty will never make a first-class engineer, and the examination, or his ability to answer questions, will not make one of him. I take the stand I do on this question from my own observation of men on railroads, and I am not drawing on my imagination; so go right on in the good work, it is only taking out a company license instead of a State.

There is a question that should be included, it refers to losing the cap or collar off the end of crank-pin, when solid-end rods are used. Let me quote a case. A man was running a passenger engine with solid-end side rods; the side rods were outside of main rod. While oiling around he missed the collar from the right back pin; he run to the end of the division, over a hundred miles, with nothing to keep the rod on the pin, and got in all right. Now I would like to ask the readers of THE LOCOMOTIVE ENGINEER what they would have done under similar circumstances? A railroad man don't have to draw very hard on his imagination to know what the result would have been if the rod had come off while running.

The man in McCook, Neb., seems to be wedded to the headlight curtain; all right, my good brother, but I fail to see a redeeming feature in the system, but don't talk about brakemen flagging; the destitute widows and helpless orphans created in the last few months, proves that they did not wield a red light nor a flag in *their* defense And now, Mr Editor, I want to offer a solution of this flagging trouble:

I propose to locate a distance post in both directions from a station, put a locked box on each post, the station agent to carry the key When a train is going to make an irregular stop, by reason of hot boxes or other unexpected causes, a flagman must go out and drop a check bearing the number of his train in the box; we know now that he has been there; at the same time he must put two torpedoes down, and he must stay there until called in.

When called in he takes up one torpedo, leaving one to notify a following train to slow down and get under control until station is passed, but two torpedoes says stop; the usual red light or flag must be used in connection with the torpedoes. The checks must be returned to the division superintendent by the station agent.

The risk of being left, or the state of the weather, must not prevent the flagman going out. The conductor's report shows that a stop was made, and the check shows that a flag was out. An engineer is not at all times looking ahead, there are times when his attention is called to some of the boiler head attachments, and just at a time when he would miss a flag, but he would not fail to hear a torpedo. Anything to get these fellows out with a flag, take a shotgun, if necessary, to make them move and protect their trains. W. DESANNO.

Corry, Pa.

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CONTENTS.

Learning Late.

The examination of firemen before promotion seems to have suddenly struck some of our roads as necessary—time some of them woke up. Lots of eastern roads are now calling in their oldest firemen, and asking them questions of all kinds, some fitting the case, and others too deep for any one.

A couple of firemen from a Brooklyn Elevated Road recently called upon us to point them out the way to get properly posted, what books to read, etc.—they had just failed to pass a very easy examination.

Both seemed anxious to learn now; they had fired over three years, but never seem to have had the chance they were entitled to. Promotions had been made on age entirely, so they had waited. They had never been told what to learn, how to learn, or where to learn; they have to keep their engines clean, and do all a regular fireman's work on short runs where there is a lay-over at each end of only four to nine minutes; the engines are double-crewed, so they see them only in service. These men have even been, until now, debarred from entering the shop—yet the officers of the road expect them to know something about locomotives.

We claim that the officers of this road are at fault for having this kind of men. They should have told them in the start what they had to know, and where to find it out, and then have examined them occasionally to see if they were learning. One of the men said that when he asked his engineer how to set an eccentric, he was told that "that was an engineer's secret." The other fireman's engineer always looked wise at a question, and told him to "figure it out himself, then he'd know." A little examination of engineers might not be amiss here; a fireman ought not to be blamed for having a poor engineer.

These firemen are scrubbling around now hunting books, reading papers, and *thinking* about their business, they should have been doing this the three years past, but it's better late than never. We think, under the circumstances, that they deserve time to post up for another trial, and, perhaps a change of engineers

Out of a late "batch" examined on the N. Y Elevated they only got one out of four. These elevated roads won't hire an engineer, they put firemen where there is little time or opportunity to learn, and then expect the men to know their business thoroughly Roads placed in such peculiar circumstances in this matter should be provided with some place where men can get a chance to learn, extra care should be taken to see that engineers impart some correct information to the firemen, and that the latter have some opportunity to learn their business, and especially the peculiarities of their own engines and service.

The N. Y Central have recently begun examination of firemen and are finding lots of ignorance they didn't suppose existed—and for which the officers are not entirely blameless—and many old firemen who have been merely time servers are liable to be dropped out.

The reform comes none too soon; but many men whose principal fault has been indolence or indifference are liable to be punished, because the operating officers have been in the past recreant to a plain duty. This trouble is not confined to one road or one section of this country, but is, with very few exceptions, as wide as the continent. Are you posted?

Motive Power of the New York & New England.

Albert Griggs has resigned his position as Superintendent of Motive Power of the New York & New England road, and the office has been abolished

Mr. E. M Humstone, for the past ten years master mechanic of the western division, has been made general master mechanic of the system, with headquarters at East Hartford, Conn In selecting Mr. Humstone for this important position the management has, without doubt, chosen one of the ablest men in New England. He is a thoroughly practical man, and perfectly familiar with every detail of his office, and the able manner in which he has for so long a period under six different managements, handled the vast amount of business immediately under his supervision, should be a sufficient guarantee to his many friends that he will experience no serious difficulty in successfully coping with the most difficult problems of his new position. Endowed with integrity, intelligence and ability, he should be enabled to fill with honor and credit the highest position to which he could be called

It is to be hoped, however, that he will be given a little better chance than his predecessor, Mr. Griggs No man in New England could handle the motive power of a road better than Mr Griggs, he was trained under his father, one of the progenitors of the American locomotive, and has had a lifetime of experience. The Valley Falls shops of the Providence & Worcester, built and managed by Mr Griggs, have long been acknowledged as the model shops of New England

The New England seems to be managed (?) by men who imagine they can run a road forever without keeping up running repairs. They have kept Mr. Griggs down from the first; he has never had men or material enough to half do his work, and the record of the road for the past sixteen months will bear us out In that time there have been over *two hundred* accidents; and this on a road operating but 477 miles of track, a short time since there were twenty-four engines awaiting general repairs They are now having a lot of engines repaired at the R I. Locomotive Works. It seems that the less a manager knows about motive power, the more he wants to monkey with it, and the more he thinks he can choke it

Mr Humstone has appointed Mr. F M. Mast, general foreman of the East Hartford shops, in charge of the western division, and Mr. J. T Brady, of the Erie, general foreman of the Norwood shops. We hope the New England management won't tie Mr Humstone's hands, as it did Mr Griggs', and then expect him to work miracles.

One of our advertisers got "onto" a new scheme the other day. He makes a device much used in the coal regions, and tries to advertise there when possible, he knows something about advertising, and has been somewhat inclined to think that "folders, maps and guides" had their uses—he knows better now. He recently had a chance to invest half a hundred in a card on a map of the Lehigh Valley road, which the solicitor guaranteed would be hung up in every waiting room on the system. He paid his money on presentation of a map with his card thereon, and awaited returns—he's waiting yet. On a recent trip over the L V he noticed the maps and put on his specks to see how his "ad" looked away from home. There was no "ad" there, and diligent search along the line failed to show one. On returning home he inspected his map closely and found that his "ad," was neatly pasted on top of another.

We have before us a printed paper, 12 pages, published by the Government of New South Wales, giving the "Conditions of Employment of Staff in the Various Branches of the Government Railways of New South Wales" It is interesting reading, but all we have to say is that if government ownership of railroads calls for as much red tape as this for a man to get on the "staff" as cleaner, wiper or fireman, we are "agin" the government ownership scheme here

Harry D. Cozens, founder and first president of the National Association of Stationary Engineers, and for more than a year solicitor for this paper, has been appointed chief engineer and superintendent of the Prudential Life Insurance Company's magnificent 14 story building at Newark, N. J. Mr Cozens is now putting in the power, lighting and hydraulic plant, an outfit as fine as money can buy The building is the finest in the State.

The historical old locomotive "General," illustrated in our issue of August, 1888, and over the capture of which one of the saddest incidents of the civil war was enacted, has at length been noticed by the people of Georgia, and a bill introduced in the legislature proposes its purchase and placing on the capitol grounds as a monument The "General," though born in Paterson, was a rebel, first, last and all the time.

Book Reviews.

PROGRESSIVE EXAMINATION OF LOCOMOTIVE ENGINEERS AND FIREMEN By John A Hill Published by J A Hill, Box 1,736, New York. Bound in cloth, price 50 cents.

We have little need to tell just what this book is. It contains the articles already published under the title in this paper, and seventeen colored plates, showing positions and color of all signals carried upon trains or engines according to the standard code. The book is bound in flexible cloth covers, pocket size, 6x4 inches, and has been put into book form to meet a demand for it in convenient shape for preservation. The book contains several blank pages on which to note differences in rules, and other memoranda.

POOR'S MANUAL OF RAILROADS FOR 1891. H V. & H W. Poor, New York

This is the twenty-fourth annual number of this well-known and standard work. It grows with the railroads of the country, of course, and will soon need to be issued in two volumes, the present number having over 1,500 pages. This is the standard work of the country on the financial condition, history and extent of American railroads, and is to be found at hand in all railroad offices, banks and financial agencies

PROTECTION AND FREE TRADE By Henry George. Published by the *Standard*, 42 University place, this city. Paper covers, price 35 cents.

This work has reached a sale of upward of half a million, and is considered a standard work on the subject indicated in the title No student of tariff matters, no matter what his belief, can afford to do without reading this interesting book

ASKED & ANSWERED.

(56) F. E. B , Cumberland, Md., asks

1. Will a line drawn through the centers of the drivers of an engine with horizontal cylinders pass through the centers of the cylinder heads? *A.*—Only in some cases; most locomotives have their cylinders set higher than the center line of drivers 2 What is the rule (if there is one) regarding the position of the cylinders when they are slanting? *A.*—There is no rule 3 What is the "valve yoke" and what is the "saddle," and what are their respective uses? *A.*—The yoke is that part of valve stem forging that surrounds the valve The castings between the cylinders by means of which they are joined is called the cylinder saddle, and the bridge from the forward to back part of the link which carries the suspension stud is called the link saddle.

(57) C. M. B., Algiers, La., asks

1st Why is the bottom arm of a rocker shaft set back on a locomotive, and as a rule how much? *A* —When it is found necessary to incline the center line of motion—a line drawn through the axle and link block—below the center line of the engine—a line drawn through the cylinder and axle—the lower end of the rocker is offset enough so that it is at right angles to the center line of motion when the upper end is at right angles to the valve stem. This is done to equalize the motion 2d Why is the saddle pin on a link set back of the radial center? *A* —To equalize the cut off. Read Elementary Lessons on First Principles, October, November and December issues of 1889

(58) C. D., Fort Worth, Texas, asks

1. Is there a machine made for bending copper tubing all sizes up to 2"? If so, who has them? *A.*—Pipe-bending concerns, making many bends alike, use rolls, but for locomotive work copper pipes are bent by hand, being first filled with rosin to prevent flattening 2. What is a good composition for making metallic packing rings for pistons and valve stems? *A* —Genuine babbitt metal is usually used; this is composed of 3.7 parts of copper, 89 parts of block tin, and 7 3 parts of antimony. Good results have been had by using 90 parts of tin and ten of antimony

(59) D. D. C , Vicksburg, Miss , asks:

1. Is there any patent planished iron made that is not dished in the center of the plate? *A.*—We have never heard complaint about the dishing before; it is almost impossible to roll sheets so thin without the rolls springing some, rolling outside of plate thinnest. 2 Is genuine Russia dished? *A* —No more than ordinary sheet metals 3. How is Russia or planished iron measured? *A* —By wire gauge

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A 140,000-mile run without any repairs is the published record of a locomotive on the Pennsylvania Railway. This engine runs between Altoona and Pittsburgh, and makes 468 miles per day Engine 337 of the Chicago division, in July, made the remarkable record of running 7,680 miles during the month.

Now while Mr. Hitchcock is writing on running repairs, we hope that every roundhouse foreman, mechanic or engineer, who wants to know the proper way to go about any repair job, to write us stating his wants, and we will interest Mr. Hitchcock in his behalf

Santa Fe Shop Notes.

Going around the country visiting railroad shops is, so far as the shops go, about like changing a horse from one field to another—there is a good deal of sameness. But I always manage to find something new and interesting in the men and in the way they do their work. Wherever there is originality or individuality there is interest, therefore the Topeka shops of the Atchison, Topeka & Santa Fe are interesting.

THE MEN

seem to do things a little different here than other places, sometimes doing them better and in other cases not quite so good, perhaps, but they *do* successfully.

I am an admirer and a lover of railroad mechanics—engine and shop men—and I am as much interested in them and their work as an astronomer can be in the spots on the sun, their successes are a source of gratification and pride to me, and I never saw one of their failures that did not do me good—taught me a lesson or pointed a moral. I read all I can find about my kind of people and listen to all I hear

WITH THE SUPREME JUDGES,

Our train was quite late out of Denver, owing to a freight train wreck and after getting started I went into the smoking compartment to suck a little inspiration out of a good cigar—a present to me.

There was a Hebrew drummer asleep in one corner, a merchant from the mountains, going east, and two young men who, from their dress and the color of their hands, I judged to be office men, and by their talk to be encyclopedias of railroad information, they were apparently employes of the claim agents or the auditing department of some road, but just then they were sitting in judgment on the Santa Fe system. They found fault with all the departments in turn, told how they would straighten out things, discussed the merits and demerits—mostly the latter—of men at the head of departments, and kindly explained to each other how the road could be saved from ruin from each source.

I shut my eyes, opened my think trap, and took no interest, knowing that sooner or later they would get to my department—the mechanical.

"There's another man that's fearfully overrated," said the younger one, pulling at a hand-raised moustache, "that man Player, John Player, the superintendent of machinery; seems to me they could get a man in America for that job; just think of paying that Englishman ten thousand a year It's pure luck on his side, just bull-headed luck, why he hasn't been in this country more than fifteen years, came here with a family, soon got to be master mechanic, and went right up ahead of everybody. Some men do have the darndest luck"—but I shut my think trap here and went to bed

I don't believe in lucky men very much, I've heard of quite a number in my life, and I always wanted to get acquainted with one, but came to sift each case down to bed rock I never failed to find a natural cause for success, altogether different from luck, so I concluded to stop off at Topeka and see what charm John Player had that made him lucky.

I found upon inquiry that Mr. Player served his time and worked as a machinist in the Woolwich Arsenal in England, that he came to this country fifteen years ago, with a family, and after some difficulty secured work as a machinist in the Iowa Central shops at Marshalltown, Iowa, was soon made foreman, and within a few years master mechanic, after several years of service here he went to the Wisconsin Central as superintendent of M. P., remaining two years, and making such a record as to attract the attention of the general manager of the Santa Fe road, and to finally put him at the head of the mechanical department of the longest railway system in the world—it does look like luck

NOT LUCK, BUT WORK

I kept watch of Mr Player for three days, and mentally took a few notes. Mr. Player seems to have plenty of time to spare, he can always see the division master mechanics, the foremen or the men; the drummer is invited in and talked with Mr. Player goes home to his regular meals, and don't thrash around and worry himself, but we noticed that somehow or other he disposed of every letter and report on his desk each day—lucky men don't do that—he seemed to know the location of everything and everybody around the plant, and had changed many things to avoid friction and facilitate getting out the work—not the traits of a lucky man at all.

I noticed that he was making use of many of the little things, plugging up small leaks and practicing small economies, that he kept a record of service of his rolling stock and figured on certain mileage for a certain cost, and was figuring to save by adopting the simplest devices and cheapening the cost of production and repairs—the lucky man cuts wages, it's easier

There is not a great deal of trouble locating the lucky charm worn by this mechanic—it's good judgment, capability, work and *system*.

But I started in to tell you something about

THE SHOP.

Well, the shop is not much good—the machine shop, I mean—it was originally built for a bridge works, and is dark and very badly arranged, the car shops and storehouse are splendid stone buildings, but, after all, the interesting parts are the men and other things inside.

LIGHT.

They used to use torches in the machine shop A nice, fat, greasy smoky torch on a hot day in summer, located just ahead of your nose, is a first class abomination Mr Player remembered that there had been an expensive electric train lighting experiment indulged in by the road a year or two ago, and found several dynamos and storage batteries piled up in Chicago—well, they are lighting this shop now

POWER

is furnished by a big Corliss engine, located in the middle of the shop. But I don't care so much for generalities. I am a specialist, and the first thing that really interested me was

A BROKEN FRAME,

no, a frame that *was* broken, it had been mended. This frame belonged to a consolidation locomotive that had been in a collision, and it was broken in five places, bent out of shape, and apparently hopelessly demoralized It had just come in from the blacksmith shop, and they were putting it under the boiler

WITHOUT PLANER WORK

The jaws were square and just where they belonged, yet one of the welds was between the jaws and on the main frame, the welds were smooth and the frame straight. Master Mechanic Smith said this was a regular thing with them, and I went right straight to the

BLACKSMITH SHOP.

I found this fairly well equipped with tools and in charge of an old-time Vulcan named Bill—I always forget the hind name—who was just superintending the welding of a frame, the weld completed, the boss squinted along the work a few times, made a measurement or two, had a blow struck here and a tap there, and said, "All right; cool her off." The men left the frame in the crane and laid straight bars of iron, as heavy as the frame, on each side of the weld, and bolted them fast with clamps, then turned a stream of water on the red hot iron. The false frame prevents the hot one from twisting or binding, and they cool off and measure to see if the frame is true and all right; if it is not, they take another heat and correct the error. It saves great expense in machine work This job did not need reheating, and was taken down. When I asked the foreman blacksmith if he "jumped" those frames together, he looked at me in disgust and said. "No jumped welds for me I 'he and she' every frame welded here, and make a job of it." Certainly the work I saw looked as if it had been drop-forged.

THE BOILER SHOP

is an important part of the plant, and a great deal of work was being done there. They have had considerable trouble from the cracking of the crown sheet or flue sheet near the seam on radial stayed boilers, and have adopted the plan of putting two crown bars in front, believing that they will admit of more expansion In this shop they have a simple flange furnace that seems to me to be a good thing. The bottom, or bed for the fire, is a sheet of boiler iron punched full of half-inch holes; this sheet has a space under it, into which the blast is introduced; the holes in the sheet are stopped up by large-headed rivets. When a piece is to be flanged, rivets are taken out just the shape and size of the fire wanted, and the live fuel piled over the bed and the blast put on; fuel will only burn where the blast is, and the result is fire where wanted, and there only.

HEADLIGHTS

are made in the shop; the lanterns are extra strong and rigid, made of galvanized iron on an iron frame. Shortly after Mr. Player took hold, he ordered all division master mechanics to send in all old reflectors on hand; the result was a crop of 105, these were replated, an ounce of silver being put on each one, to do this, they solder a piece of tin over the two holes on the outside and then fill the reflector with the plating solution.

MONEY IN THE SCRAP.

The 105 reflectors only show what might be expected if the scrap was looked over. One result was the shipping to Topeka from all along the 8,000 miles of road of over 12,000 air-brake hose-heads; these were sorted, new gaskets put in some, the torn hose cut off, and hose bought in coils to fit them to—the resultant saving will almost pay John Player's big salary for a year, and there are still great possibilities in that scrap pile

BABBITTED BRASSES

have the regulation two strips of soft metal from end to end of the brass, except that there is a strip at each end enclosing the space between the longitudinal strips, this holds oil.

A NEW IRON BRAKE BEAM,

designed by Mr. Player, is being used. It is made just opposite to the National hollow beam; the pipe section is the arch or compression members and are in two pieces, with the tension rod straight across. It works well. Mr. Player's driving brake shoe, with chilled cutting edges, is also giving good service.

RIGID CENTER TRUCKS

are being used for engines, tenders and freight cars The first cost and repairs are far below swing motion trucks, and extended experiment has shown them fully as safe, if not the safer of the two kinds

CAST STACKS,

base and all in one piece, are finished ready for the engine, at a cost of $1 85 per hundred pounds, and weigh about 350; they are cut off at the top straight, without even a bead, experiments showing that smoke is trailed in exact proportion to size of the top ornament of stack

NOZZLES

of very large diameter are used; they are annular, and of the pot-belly or reservoir order, the adjustment for size being at the junction of the two pipes, the upper or final opening being much larger. The exhaust from this pipe is the easiest I have ever noticed, except with the Smith triple expansion pipe.

SHORTENING FIRE-BOXES.

In a large class of consolidation engines, with ten-foot fire-boxes, they have bricked over the grates for the front four feet, making a large combustion chamber of the front of box; they steam well with the big nozzle and the poor Kansas coal—24 to 30 per cent. of carbon—and just think of the comfort to the fireman.

COMPOUND ECONOMY

There is a 2-cylinder compound engine in service here, and she has shown a saving of fuel over the ordinary engines, running from 29 to 31 miles for a ton of coal, against their 20 to 22 miles; but there is a new class of ten-wheelers, of the Brooks build, with the big nozzle, that is just about equaling the compound. The men have become interested, and are proving what I have for years contended, that they, the men, could be improved to show more economy than can be shown by compounds or anything else

THE PAINT SHOP

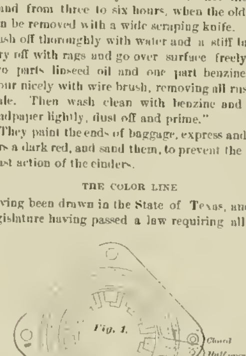
is very elaborate, but not large enough to do the work on hand. They are changing the passenger car color from yellow to Tuscan red, and they have cleaned up and fitted an abandoned roundhouse to help them out. They take in a coach that is not bad, repaint and varnish inside and out for less than $40. The system of keeping paints and painter's tools, and the system of standard lettering is worthy a special article longer than this. They have a mortar that they apply to old tanks, wheels, etc., to remove the paint, that works admirably. Master Car Painter Hogan has a set of rules and formulas for painting, and this mortar and its use is described as follows.

"When it is necessary to remove old paint from cylinders, tank, steam chest, driving wheels, rods, etc., use a preparation of 25 pounds potash, 5 pounds sal-soda, 1 quart light liquid ammonia, 25 gallons water, made stiff with dry slaked lime, and applied with bricklayer's trowel. Let the coat stand from three to six hours, when the old paint can be removed with a wide scraping knife. Then wash off thoroughly with water and a stiff broom. Dry off with rags and go over surface freely with two parts linseed oil and one part benzine, and scour nicely with wire brush, removing all rust and scale. Then wash clean with benzine and rags, sandpaper lightly, dust off and prime."

They paint the ends of baggage, express and mail cars a dark red, and sand them, to prevent the sand-blast action of the cinders.

THE COLOR LINE

having been drawn in the State of Texas, and the legislature having passed a law requiring all rail-



NEW VARIABLE NOZZLE.

roads in that State to furnish separate cars, or apartments, of the same class for colored people, the Santa Fe, with other roads, were hustling to comply with the law. During my visit the cabinet shop was busy on 46 partitions for cars to run in Texas. These were finished inside like the cars they were to fit, and an extra lavatory was being made for each coach.

NEW ENGINES

are mostly of the Brooks make, and they are building one or two eight-wheelers in the shop. The Santa Fe has every kind of locomotive put up in this country within thirty years, some good, some just middlin', and a whole lot absolutely bad. The last of the Strong engines built stands in the roundhouse Every effort has been made to make the engine a success, but they have given it up, and she will soon be rebuilt into a regular made-a-purpose locomotive, the wheels and frames being pretty good, and the tank and truck all right

TIRE WORK

on a road having over 800 locomotives is heavy, and three lathes are here kept on the jump. They turn from 100 to 140 tire per month, and a couple of Bement steel-tired car wheel lathes are busy on coach wheels.

Master Mechanic Smith has increased the output of his shop greatly by putting a tool on special work, and speeding up the tool to all it will stand.

TOOL-ROOM

A tool-room has recently been established, and a new feature, to me at least, is to so arrange the place for each tool that no other tool will go into that place, so that it is entirely impossible to put an inch S wrench in the place of the inch-and-a-quarter wrench J. A H

New Variable Nozzle.

While at Portland, Ore., a short time ago, the writer saw in use on the O., R & N road a new form of variable exhaust nozzle, designed by Mr. Fred. Mertsheimer, superintendent of the Cheyenne shops of the U. P.

The nozzle proper, or tip, is divided horizontally, the lower part having teeth projecting toward the center. A cover fits above these, and is held down by an external flange. This cover is a duplicate of the lower ring, having, in addition to the internal teeth, a handle, whereby it can be moved around so that the upper teeth match with the lower, forming a plain opening for the escape of the exhaust, or one set of teeth can be placed above the other, leaving the openings between teeth clear, thus increasing the area of opening.

The sketches make the matter clear.

This nozzle has been used to considerable extent on the U P, and a saving in fuel is reported from it We are of the opinion, however, that it is a very difficult matter to tell whether saving is made by such a device, or by the extra care of the men using it. Let the U. P. take their coal records for last year, and offer the crew one dollar a ton for all fuel saved over last year's performance, and the result will be something surprising. Some of the poor engines, with plain nozzles, short fronts, and other old-fashioned trimming, will be found to show big percentages of saving.

One of the greatest advantages, if not the greatest advantage, of a variable nozzle on fast engines, is the extra relief it affords the engine when running very fast shut off.

Free Scholarships in the Stevens Institute.

This year the Master Mechanics Association disposed of some $8,000, known as the Boston Fund, by purchasing four perpetual scholarships in the Stevens Institute of Technology at Hoboken, N. J. These scholarships will give to the association an educated ward every year, and it is hoped and believed that this will be worth more to the association than monuments in the shape of club houses or granite pillars. The following circular explains the conditions of awarding the free scholarships.

The scholarships which this association has secured in the Stevens Institute of Technology, Hoboken, N. J., will begin this year, and candidates are required to be in attendance for examination on the week beginning September 28. Candidates must be the sons of members or of honorary members of this association in good standing, or the sons of deceased members who died in good standing. They must also have worked for at least one year in a recognized machine shop, and they are required to take the course of mechanical engineering. The rules of the school require applicants for admission to be over seventeen years of age.

Candidates for the scholarships should apply to the secretary of this association, and he will supply them with certificates if they are found eligible.

There are four scholarships open this year, one for four years, one for three years, one for two years, and one for one year's course. The candidates for the four years' course will be required to pass the Freshman examination, those for the shorter terms will be required to pass the examination of the scholars belonging to the respective years.

Candidates for admission to the Freshman class will be examined in the Stevens Institute on the following subjects:

Arithmetic.—The preparation should be especially thorough upon the properties of numbers, the operations in common and decimal fractions, the methods of finding the greatest common divisor, and the extraction of the roots of numbers.

Algebra.—Simple equations, theory of radicals, equations of the second degree, arithmetical, geometrical progression, permutations by binomial theorem, indeterminate coefficients, logarithms, and series Great importance is attached to a thorough knowledge and readiness in the solution of simultaneous equations of the second degree and the reduction of radicals

Geometry.—All plane, solid and spherical geometry. The examination in this subject will be thorough, and the applicant must show a familiarity with all the fundamental geometrical forms and be able to demonstrate their properties and relations He should also be able to point out the most important ones.

Analytical and Plane Trigonometry.—The fundamental formulae and their demonstrations, as well as the solution of plane triangles by means of natural and logarithmic tables, will be insisted upon

English Grammar.—The requirements are a practical acquaintance with the parts of speech, their relations, agreements and government, the proper use of tenses and moods, the construction and arrangement of sentences

Composition.—An essay upon some topic assigned at the time of examination, and examined with reference to legible handwriting, correct spelling, punctuation, and proper expression.

Universal History.—In the examination in universal history but little prominence is given to dates The questions relate to the great events, their causes and effects. A conspicuous place is given in the questions to the history of the United States Text-books—Myers' or Barnes' General History and United States History, or Johnston's or Higginson's or Eggleston's United States History, or Montgomery's American History

Rhetoric.—The examination in rhetoric will embrace all parts of the subjects which are contained in the text-books on rhetoric. Text-book—Hart's Rhetoric.

French.—The examination will be on translation from Knapp's Modern French Readings, the first half of the book, or from some equivalent, such as Super's French Reader or Fontaine's Historiettes Modernes

Physics.—As much of physics as is contained in Part I. of Deschanel's Natural Philosophy. (D. Appleton & Co., New York, publishers.)

If there is more than one candidate for each scholarship, the applicant who passes the highest examination will be chosen. This will be settled by the school authorities.

ANGUS SINCLAIR, *Secretary.*

Subjects to be Discussed at the Next Meeting of the Master Mechanics.

Secretary Angus Sinclair announces by circular that President Mackenzie has appointed the following committees for conducting the business of the Master Mechanics Association for year 1891-92

No. 1. Exhaust Pipes, Nozzles and Steam Passages.—C. F. Thomas, A. W Gibbs, L S Randolph, J. M Wallis, George W Smith, Robert Quayle, John Y Smith

No. 2. The Present Status of the Car Coupler Question.—John Hickey, G W. Rhodes, Sanford Keeler, R. H. Blackall, M N Forney.

No. 3. Standard Tests for Locomotives.—To investigate the practicability of establishing a standard system of tests to demonstrate the fuel and water consumption of locomotives; also to ascertain the value of the steam engine indicated in locomotive tests.—J. N. Lauder, J. Davis Barnett, Albert Griggs, John D Campbell, F W Dean.

No 4. Compound Locomotives.—To investigate the relative economy of compound and simple locomotives; also the most valuable form of compound locomotive.—George Gibbs, William H Lewis, Pulaski Leeds, James Meehan, T W. Gentry, A. T. Woods.

Auxiliary Committee.—S. M. Vauclain, Baldwin Locomotive Works; Reuben Wells, Rogers Locomotive Works; H N. Sprague, Porter Locomotive Works; A J. Pitkin, Schenectady Locomotive Works; Joseph Lythgoe, Rhode Island Locomotive Works, F. J. Leigh, Canadian Locomotive Works; D A. Wightman, Pittsburgh Locomotive Works.

No. 5 Tests of Steel and Iron. To investigate the critical temperature of steel and iron. Also any other questions relating to steel and iron that the committee may consider of value.—William Smith, J N. Barr, A. W. Quackenbush, P H. Peck, D. L. Barnes.

No 6. Uniform Locomotive Performance Sheets.—To report on the practicability of establishing a system for recording the performance of locomotives that will fairly represent the work done.—George F. Wilson, J. S McCrum, John Player, James McNaughton, John A Hill

No. 7. Standard Bolts and Nuts. To report on the best taper for bolts, and the proper size of nuts, rough and finished, also to report on accurate measuring gauges.—William Swanston, William Garstang, T. W Gentry, W. Lavery, A. Dolbeer, L. R Pomeroy.

No. 8. Rollers for High Pressure Locomotives.—J M. Boon, H. D. Gordon, J. S. Graham, J. H. McConnell, W. H. Marshall.

No. 9. Air-Brake Standards and Inspection and Care of Air-Brakes.—R. C. Blackall, G. W. Stevens, David Clark

Committee on Subjects for Investigation.—J Davis Barnett, George Gibbs, William Smith.

For the Executive Committee,

ANGUS SINCLAIR, *Secretary*

A Signal Holder.

BY L. C. HITCHCOCK.

There are many different appliances on as many different railroads for holding signal lanterns on the back end of engines and tenders, but among the many I have never seen any which exactly fills the bill, according to my notion.

Some have tin or sheet-iron boxes, with tops and two sides of each left open, in which to place

Fig. 1.

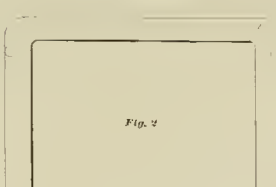


Fig. 2

Fig. 3.

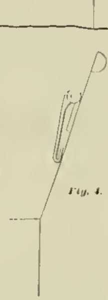


Fig. 4.

the lanterns These boxes are sometimes placed on the tender decking, one at each end of the back tool box. The trouble with these arrangements is that they are an expensive thing to make, and, as two are required for each engine, this is quite an item. Then they are clumsy looking, and lanterns placed in them cannot be seen to advantage. Another objection to their use is that when they are placed on freight engines the brakemen are liable—yes, almost certain—to use them as receptacles for links and pins.

In some cases these boxes are placed on top of the tender, back of the coal board, and when so placed they can be seen better, but are in the way of brakemen when they climb over the tender

Another plan I have seen adopted is to put hooks near the top of the flare or wing of the tender, on which to hang the lanterns by the bails. The trouble with this arrangement is that the lanterns swing against and injure the paint work of the tenders, besides being very dangerous things to trainmen. I have known men to sustain very serious injuries from being impaled on these hooks

Some take blocks of wood large enough to receive the bottom of a lantern, and cut them to such a bevel that when they are placed one on each back corner of the cab roof, lanterns placed on them will stand level, the lanterns being held in place by springs or some such arrangement This plan has its advantages over those previously mentioned, one of which is that it is more out of the way, and the lights can be easily seen; but the disadvantage is that they cannot be seen by the engineer or fireman, and are liable to be extinguished without the knowledge of either.

Not having any standard arrangement for holding signal lanterns on our engines while running light, and being required to find something which could be adopted for this purpose, I looked the field over pretty carefully, noted all of the imperfections of the appliances mentioned, and conceived the following idea, which, when put into practice, proved to fill the bill better than anything I had previously seen And for the benefit of those readers of THE LOCOMOTIVE ENGINEER who have no standard appliance for this purpose, I will explain what I did As it is cheaply made, and no patent on it, those who try it I think will be pleased with the results obtained.

Take two 6" strap hinges, and cut off one side 4" from the joint, the other end cut off 2' from the joint, bend a hook about ½" long on the longer end. Fig. 1 represents the hook ready to rivet to the tender. Rivet a hook on each side of the flare (on the inside), at about the points indicated by the small circles, Fig 2, allowing the hooks to just appear above the bead, as represented by Fig 3. Place the lower guard wire (not the bail) of a lantern in the hook, and the lantern will stand as shown in Fig. 3, with two of the upright guards resting on the top of the bead. Our experience here has proven to us that no ordinary jar will displace the lantern from this position. The only point that the lantern touches the tender is on top of the bead, and no injury is done the paint work

Signals in this position can always be seen by both engineer and fireman every time that they look out of the window. They can also be seen from all points in the rear of the light engine carrying them. When not in use, the hooks should be thrown down, as shown by Fig 4 In this position they are entirely out of the way and cannot be seen.

This device, we find, fills the bill in every respect, is cheap, and *unornamental.*

Talk to Your Fireman.

It is the duty of a locomotive engineer to show his running orders to his fireman. If you are ordered to sidetrack at Tolter for No 9, the fireman commences to figure on that If he has a good steamer he will let his fire burn low in nearing a meeting point, so his engine won't pop. If he has a poor steamer he will scheme to keep his steam up to the meeting point, and in either case, if the engineer pulls by, the fireman will be the first man to notice it. It will not detract from the engineer's position to mix up a little, socially, with his fireman in this way, and it will make the fireman a good engineer. If we were making train rules we would compel engineers to do this, and if that failed to work we would have an extra copy of the train order made for the fireman. The conductor should show his orders to the brakemen. The average brakeman is a much smoother man on train orders than the fireman, but he is not so sure to remember them, for the very reason given in the beginning of this article. Had Engineer Hopkins shown his orders to his fireman, the awful Carlile collision could not have occurred Many will object to this, and say it is unnecessary and takes too much time It will probably take some time to rebuild these engines and cars—it will take some time for the woundist to get used to their wooden legs—it will take some time to heal the broken hearts of the widows of the dead. Talk to your fireman —*Western Railway.*

The Russian Government has requested a Canadian syndicate to tender for the work of constructing 400 miles of the eastern section of the Siberian Railway from Vladivostock to the Amur River. The *Times* (London) says Mr. George Keefer, a leading Canadian engineer, will proceed to Siberia immediately.

"Pig-iron" is a mere play upon the word sow When iron is melted, it runs off into a channel called a sow, the lateral branches of which are called the pigs Here the iron cools, and is called pig-iron.—*Ex.*

Some New Grinding Machines.

The engravings on this page show three forms of a new and unique grinding device being placed on the market by Pedrick & Ayer, of Philadelphia.

They are built on a new principle entirely, and have the great advantage of simplicity. No pumps, troughs or separate tanks are used to handle the water. It runs by gravity to the center of the wheel, and is returned to the case, or tank, by centrifugal force. The No. 8 horizontal grinder is

No. 8 HORIZONTAL GRINDER.

the one usually employed for grinding machine shop tools. It has two emery wheels, the shaft running through removable bronze bushings in the head. The tank is filled at the top, and water turned upon the stone near the center. It remains upon the stone by capillary attraction until enough has accumulated to be thrown to the largest diameter of the wheel by centrifugal force. The edge of the stone is inclined, and the water is finally thrown into the iron rim around the wheel, and forced into an opening to the water tank again.

When the water becomes foul, it is drawn off into the bucket shown, and emptied, the bucket holding exactly enough to fill the tank again.

Repeated attempts to draw the temper of tools on these wheels has demonstrated that it is practically impossible, as the wheel will carry more water than can be used possibly.

The builders will make this machine in several larger sizes.

The twelve-inch upright wheel shown is designed for wood-working shops. The grinding face of the wheel is slightly beveled, to admit of the handling of long knives. The outside rim of the bowl can be lifted off if necessary. The shaft runs in removable bronze bushes, and the belt carrier is shown in the cut. This tool automatically supplies itself with water, and returns that used to the tank.

The coned wheel, bench machine is used for grinding inside gouges, cutters, formers, etc., and is especially useful in pattern and wood-turning shops, as well as for grinding molding and shaping machine cutters for car shops and planing mills.

Water is supplied to it the same as in the horizontal grinder, and the construction is plain from the cut.

These machines are new, very efficient, and can be made and sold for much less than more cumbersome and trappy grinding machines.

Life-savers in Overclothes.

An incident occurred on the Saginaw branch of the D. L. & N. road last Thursday, which adds laurels to the reputation of Engineer Weidman and Fireman Corbus, who go out on the passenger train which leaves Howard City for Saginaw at 8:40 A. M. The train was approaching a siding known as Belvidere, at a high rate of speed, when Mr. Weidman discovered, some distance ahead and close to the right-hand rail, an object which proved to be a little child, about a year and a half old. The brakes were applied in full force, the engine reversed, and every means used by the engineer to stop the train, but it was found impossible, and had it not been for the quick-witted and clear-headed fireman the child would have been struck and killed. He hastily climbed out of the front window, along the side of the engine, down onto the pilot, and when within a few feet of the baby he sprang to the ground, and grabbing it in his arms, jerked it from in front of the train just as the engine thundered over the place where he had been sitting by the rail. The act was a gallant one, which will no doubt cause him to be ever remembered with gratitude by the mother of the child. This is the second experience of a similar nature which that locality has furnished, a child having been struck there by an engine two years ago.—*Howard* (Mich.) *Herald*.

[Acts of this kind are not uncommon on railroads, but who ever heard of an engineer or fireman getting a medal?]

Growth of Our Railroads.

A wonderful story of growth is told in the following figures, showing the railway mileage of the United States by decades for the past sixty years

In 1830	23	miles
In 1840	2,818	"
In 1850	9,021	"
In 1860	30,626	"
In 1870	52,922	"
In 1880	93,296	"
In 1890	166,817	"

In the last ten years the increase was 73,521 miles, or more than 78 per cent.—an average of 7,350 miles each year. If the increase in the next decade is only 5,000 miles per year, our railway mileage in 1900 will be about 217,000 miles.—*Railway Age*.

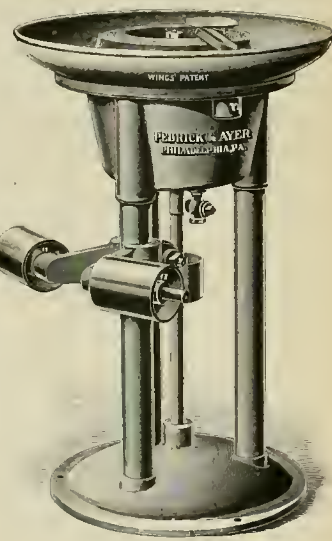
CONED WHEEL, BENCH MACHINE.

Orville H. Reynolds, chief draftsman of the Northern Pacific road, who wrote the splendid series of articles on drawing for this paper, has been appointed mechanical engineer of the entire system, with headquarters at St. Paul. Mr. Hickey has done the proper thing in recognizing a record of devotion to duty and an untiring effort to promote the interests of the road by a young man whose ability has been proven by years of service instead of importing an unknown quantity with some initials behind it.

Several inventors claim the first use of outside cylinders and plain axles—the "Rocket" had both

Cold Truth About Railroad Managers and the Motive Power Departments.

A well-known railroad man who has recently been appointed general manager of a busy road, sends us the following letter, which came into his possession with the other archives of his office. He says: "The former general manager has retired to private life, the M. M. is still here, got what he wanted, and deserved it all. The letter is too good to keep." The man who wrote



TWELVE-INCH UPRIGHT WHEEL.

this letter is well known to the readers of this paper:

G. P. X——,

Gen'l Manager X. X. & X.

DEAR SIR: Some days ago you sent your messenger boy to me with a note, asking what it would cost to grade and put in four new tracks in the repair yard that I had asked for, and requesting a reply by bearer. I told you that I did not know, but could find out if you had any aversion to referring the matter to the road master's department, and now have before me your sarcastic, ridiculous and amusing "roast."

You seem to think that the head of the mechanical department should be an encyclopedia of railroad information, and know everything for your special benefit—for two thousand a year.

I have on file in this office more than one hundred letters and notes from you, asking all kinds of questions on all kinds of subjects, to every one of which I have made some reply; I have gone with you to inspect bridges and buildings, helped formulate time tables, select petty officials, and, through your orders, interfered with the purchasing, track, bridge and storekeepers' department, until I am sick of it.

You have sought and received my honest advice about every subject coming to your attention, so far as I can learn, except the single one of rates, (and God knows that's in the worst muddle of them all).

You expect me to pull ten coaches, forty miles per hour, with a 17-inch engine. To keep more than one hundred engines and four thousand cars in repair with a handful of men—and make all my own material out of scrap.

I do not know how much it would cost to put in those tracks, nor how long it will take—neither do I know how long it took the Lord Almighty to make this county.

I pretend to know something about my own de partment, however, and wish to go on record as having called your attention to the following facts, to wit

I need 20 extra men, mechanics, to keep up running repairs and get power in shape for fall rush, and I need them now—if we don't get them we cannot handle business of last year, and you say this year will be heavier.

We have twelve 16-inch engines that are unsafe to run—they need new boilers. I advise their sale as scrap, and the purchase of eight consolidation engines with 19 or 20 inch cylinders—we are short of power. We need a new wheel lathe—been asked for in every requisition for three years—costs money to send wheels away for tire work.

I want permission to raise the pay of engineers on freight half a cent a mile, and firemen one-quarter of a cent—they earn it, and it will prevent a strike. I want to be relieved as general adviser and non-commissioned *factotum* to the general manager, and left time and opportunity to attend to the thousand duties of the M. P. department.

I want my title changed to Supt M P and R S., and credit given me for what I do, and nothing for what I do not do.

I want the roundhouse roof painted, a carpet for my office, the gas pipe fixed, and the flue rattler buried so that I can think, and then I want the pay of a Supt. of M P.—say $5,000 per year—I throw in all other service already rendered If you think this is too much to ask at once, please look into your letter file and see how far most of the requests reach back, and average them

Honestly, don't you think you have been unreasonable with myself and my department? Haven't you expected, asked and received too much? Sleep on it, and if you don't agree with me in each and every particular—especially the $5,000—please accept my resignation, to take effect at once.

Seriously yours,

[And there are many more who need to take the same kind of a stand.]

The Open Switch.

Cy. Warman, editor of the *Western Railway*, at Denver, Col., has written and copyrighted a new song with the above title. It has been set to music by H. B Iszard, and is being published and sold by the Railway Publishing Company, of Denver. Price, 50 cents. It sounds like Cy The words are as follows:

All the summer, early and late,
  And the autumn days so drear,
A maiden stood at the orchard gate
  And waved at the engineer
He liked to look at her face so fair
  And her homely country dress,
She liked to look at the man up there
  At the front of the Fast Express

There's only a flash of the maiden's eye
  As the engine rocks and reels,
And then she hears in the distance die
  The clinkety-clink of wheels
Clinkety-clink, and a mile apart,
  And the fireman seems to hear
The clinkety-clink of the maiden's heart
  And the heart of the engineer.

Over the river and down the dell,
  Beside the running stream,
She hears the clang of the engine bell
  And the whistle's screech and scream
Clinkety-clink, so far apart
  That nothing can she hear,
Save the clink of her happy heart
  And the heart of the engineer

Even the trembling steed of steel
  Seems to understand
Their sweet distress, and seems to feel
  The touch of a magic hand
Clinkety-clink, so far away
  In the twilight dark and drear;
But what does the heart of the maiden say
  To the heart of the engineer?

The subdued sound of the engine bell,
  As the Roger rolls away,
Seems solemnly to toll the knell
  Of the dim and dying day
Clinkety-clink—there's an open switch —
  Oh! angels, hide her eyes
Clinkety clink—they're in the ditch —
  Oh! hear the moans and cries.

Clinkety clink—and down the track
  The train will dash to-day.
But what are the ribbons of white and black
  The engine wears away?
Clinkety clink—oh! worlds apart—
  The fireman hangs his head;
There is no clink in the maiden's heart —
  The engineer is dead

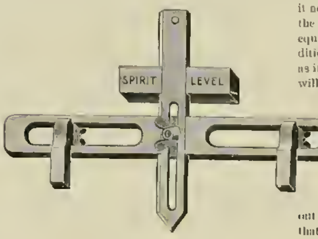
Last call—we won't mention it again No notice taken of letters without signature. No matter whether they ask questions or not, they go into the *scrap*. Believe we said this before

Air-pump Repair Kinks.

At the Mandan shops of the N P., they have a man on air-brake repairs of more than ordinary intelligence, and he has fixed up several little schemes of his own to help in his work. In the reversing cylinder there is a port very close to the bottom of the casting. Steam often gets to leaking from this port past the side of bush to the bottom, preventing the prompt work of the pump. Instead of throwing these bushings away, and putting in new ones, he turns a shoulder in the bottom of the piece, and fits a brass ring around it. This makes a steam-tight joint when put back into the head. They experienced considerable trouble here from the earlier pattern of 8 inch pumps cracking their top air cylinder head. This was on account of the spring of the casting connecting the two heads To obviate this he puts a stud from one cylinder head to the other, and exactly in front of the piston On the Central Pacific we saw some pumps braced the same way, except that the support was put onto the front of the heads and cylinders, and held by tap bolts entering the side of the cylinder flange.

A Guide Ranger.

The cut shown herewith represents a little tool now being introduced by W H Ermentrout, of Reading, Pa. It is used to put up guides, without using the crosshead or piston.



A line is stretched through center of cylinder, the lower guide put in place, and this tool placed upon it, instead of the crosshead. The pointer is used to point the line, and the guide can be fastened up parallel with the center line of the cylinders. A spirit level is also used when necessary. It is slipped off and reversed when putting up the top guide.

"Crazy Again."

Last month a well-known railroad official called on us and complimented the paper on the faculty it has of getting facts into men through a story or some other process than cold facts, tables, or algebra. Speaking of the disposition of certain classes of men to "skip" figures in reading, he made the assertion that not one man in a thousand would notice a couple of ciphers added to or taken away from a row of figures. One word led to another, and finally we selected an item containing figures, put on the same head as above, and deliberately changed 300 into 30, and made fun of the idea of there being 300 miles of locomotives in the United States

This item has been copied in two other papers and properly credited to us, and only two readers have written to point out the error in the figures—Mr. J. H Burrell, of Germantown, Pa , and Chas. E. Rice, Lockland, Ohio.

We have no doubt that many readers said, mentally, "He's off his base himself," but only two took the trouble to correct us. The fact remains that figures are not read with enough care, and papers should be careful to state facts only, especially when dealing in figures, for a large class of readers depend upon them for correct information

Discharging Employes in Times of Light Traffic.

Under the title of "Easy Lessons in Railway Economy," Wm. S Huntington is contributing a valuable series of articles to the *Railway Age*, the following being the best one we have seen so far.

It is a common custom on most railways to "shorten help" all along the line as soon as there are indications of a falling off of business, in order to keep the earnings ahead of expenses, and give an air of thrift and eke out a dividend, which makes a quarterly report read well. Net earnings are very desirable at all times, and the proper way to reduce expenses is to keep the road and equipment in such condition that trains may be run with the least possible wear and tear It should have been learned long before now that the better the condition in which a road and equipment is kept, the greater will be its profits per ton carried; in other words, if two or more roads are competing for traffic and cutting rates, the road that is in the poorest condition physically suffers the greater loss on a given amount of freight carried, because the wear and tear is greater than on a road that is kept in good repair Therefore, in view of rate wars, it is better to keep the road always in fighting trim, and in time of peace prepare for war.

Of course, when trains are laid off for want of business there will be no use for the crews, and they can take a vacation or seek employment elsewhere; but it hardly seems advisable to set the idle cars on the back track and discharge the shop hands. It would seem more like business to give the cars and locomotives a thorough inspection, and put them in for repairs When rolling stock is temporarily out of service is the best time to give it needed overhauling Then there is no rush, and the work can be thoroughly done, and when the equipment is called into service it will be in a condition to earn many times the cost of repairs, whereas if the repairs are neglected a revival of traffic will be very likely to strew the right of way with wrecks With a rush of freight and the back tracks half full of cars that are unfit for service comes confusion, loss of time, bad work done in a hurry, and the innumerable yard accidents that are unavoidable in rushing work in a crowded shop and yards Moreover, if cars are repaired soon after going out of service they will be ready to replace those that are disabled or destroyed in collisions or otherwise, without delay and confusion, both of which are unpleasant and expensive.

Some managers take advantage of a slack time for business, and put everything in good order for the rush, and these roads are classed as "lucky," because they can do an immense business with scarcely an accident When these officials discover that repairs are not coming in fast enough to require the full force of the shops, the spare time and machinery are employed on new work, which they will need in good time. As a rule, rolling stock that is made at home to wear out is more serviceable, and therefore more profitable than that which is made to sell. Of course, if this plan is pursued some material must be kept in stock, but the advantages arising would much more than pay interest on the cost But it is noticeable that those whose practice is in accord with what is here recommended are not obliged to pay interest on the cost of supplies, as they have enough left over after paying the damage account out of the earnings. The interest will be figured into the cost of keeping material in stock anyway, but there is a great difference whether the amount is found with the net earnings, or must be borrowed, as well as amount of the first cost. There are circumstances under which it is economy to shorten the pay roll, but the practice is far too prevalent for the good of the stockholders. To employ a sufficient force to put permanent way in good condition before winter sets in, and then reduce the force, is advisable, because nothing more than repairs that are actually necessary can be profitably done in winter Before shortening the pay roll it is well to study closely what the effect will be later on Not long ago when a great reform (?) party assumed control of the U S government they economized by discharging government employes. On the Atlantic coast a life-saving station was discontinued, and the crew discharged, as a great reform measure In less than a year several hundred lives and a war vessel costing a million and a half were lost there for want of a lighthouse and life-saving crew.

It is Time.

The Southern Pacific and the Rio Grande & Western have issued the following circular.

"On account of the large number of freight cars coming to us not equipped with automatic brake, our expenses have been largely increased, and the additional risk that we assume in allowing these cars in our trains has been the cause of many serious accidents.

"It has been decided that on and after August 1 we cannot receive on our line at any of our connections freight cars not equipped with the automatic brake. Cars that we have heretofore taken into our trains piped, so as to work the air through them to the cars equipped with the automatic brake, will hereafter be rejected."

These roads, having grades of over 200 feet per mile, cannot afford to risk their fine engines and finer men by hauling any sixteenth-century-brake-on-one-truck cars owned by railroads that are ten years behind the age. This stand is the right one for all the well equipped mountain roads to take.

William Thompson, who for the past five years has held down the job of general dispatcher and traveling engineer of the western division of the New York Elevated road, has been appointed general dispatcher in charge of the Mott Haven shops, and all the engines and men running into the Grand Central station, in this city. "Billy" is one of the best known railroaders in the East, capable, energetic and fair he manages to do his work and keep the respect and regard of his men, as well as the officers above him. "Billy" put in a good many years at the throttle—eight in India, as many more in South America, and has run in this country on both coasts. He is the best railroad story-teller in America, and shines as an after-dinner speaker full as brightly as Chauncey M.—after the kerosene is passed. The New York Central can congratulate itself on getting Billy. He'll keep things moving in the yard, and—what a team they have in "Chaunc' and Bill."

E. J. Rauch has been promoted to the position of general engine dispatcher of the western division of the elevated road in this city, to succeed Wm. Thompson, resigned. Mr. Rauch ran a locomotive over 40 years, and hasn't forgotten an incident of the experience.

GEO. WESTINGHOUSE, JR., PRESIDENT. T. W. WELSH, SUPT. JOHN CALDWELL, TREASURER. W. W. CARO, SECRETARY. H. H. WESTINGHOUSE, GENERAL MANAGER.

THE WESTINGHOUSE AIR BRAKE COMPANY,

PITTSBURGH, PA., U. S. A.

MANUFACTURERS OF THE

WESTINGHOUSE AUTOMATIC BRAKE.

The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 22,000 engines and 270,000 cars. This includes 180,000 freight cars, which is about 18 PER CENT. of the entire freight car equipment of this country. Orders have been received for 120,000 of the improved quick-action freight brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped.

E. L. ADREON, MANAGER. JOHN B. GRAY, AGENT. C. C. HIGHAM, GENERAL SUPT.

THE AMERICAN BRAKE COMPANY,

NEW YORK OFFICE, 160 Broadway, JOHN B. GRAY, Agent.

THE WESTINGHOUSE AIR BRAKE CO., Lessee,

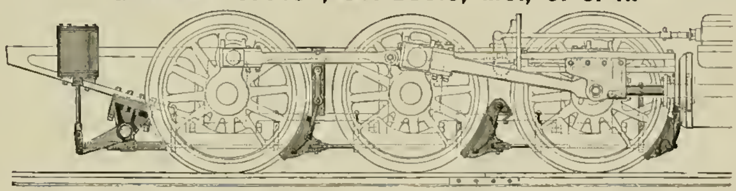
CHICAGO OFFICE, GRAND PACIFIC HOTEL.

MANUFACTURERS OF

LOCOMOTIVE BRAKES.

GENERAL OFFICE, ST. LOUIS, MO., U. S. A.

BRAKES Made to Order for any Special Form or Class of Engine.



All Power Utilized and Equally Distributed. Maximum Pressure. Minimum Wear & Strain to Parts of Engine.

Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers, furnished to operate with either STEAM, AIR or VACUUM.

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GREASE,

FOR STEAM OR GAS PIPES, BOLTS, SCREWS, ETC.

Far Better and Cheaper than Red Lead.

Makes a tighter joint than red lead, that can be opened with perfect ease many years after.

No longer any necessity for

BROKEN PIPES, STRAINED TONGS or LEAKY JOINTS.

Put up in 1 lb., 5 lb., 10 lb., 25 lb. & 50 lb. packages.

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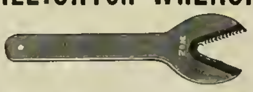

These Wrenches are forged solid in one piece, from best refined iron, with tempered steel jaws. They have ratchet teeth, cut diagonally across one jaw, thus enabling them to bite with three teeth at once.

INVALUABLE TO ENGINEERS, GAS-FITTERS AND JOBBERS OF ALL KINDS.

THE "LACKAWANNA" LOCOMOTIVE GREASE CUP

Specially adapted for use on

CRANK-PINS, GUIDES, ECCENTRICS, AND OTHER BEARINGS.

A POSITIVE FORCE FEED WITH PERFECT REGULATION.

Pressure on Grease can be instantly released by hand, without wrenches or screws. Engineer can see at a glance whether Feed is on or off. Tested on locomotive crank-pins in hard daily service.

In regular use on the Erie & Wyoming Valley R. R. (with but one filling each week), the Suburban Rapid Transit R. R. (N. Y. City), and other roads.

Our "Lackawanna" Compound is specially recommended for these cups, being first-class in quality and low priced.

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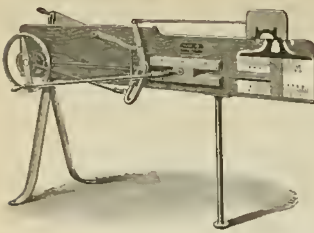

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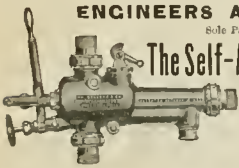

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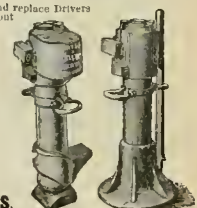

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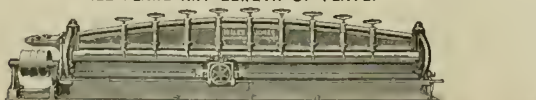

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THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 10 | NEW YORK, OCTOBER, 1891. | $1.00 per Year or 10c. a copy.

"Old Betsy"—A Queer Specimen of Combination Railroad Equipment.

You don't talk of queer locomotives much out in California until some of the boys ask you if you ever saw "Old Bets." This peculiar combination of locomotive, tank, baggage car and coach is shown in our illustration.

She seems to be fatherless and motherless, and was doubtless made up of odds and ends from some scrap heap.

Her present engineer, W. J. Brennan, writes of her as follows:

"I am unable to give you many facts about the infancy of 'Old Bets,' but her boiler front bears this legend: 'Vulcan Iron Works, 1865.' [There is a Vulcan Iron Works at Wilkesbarre, Pa., and one at San Francisco.—Ed.] Her drivers are 48-inch car wheels, made by A. Whitney & Sons, Philadelphia, Pa., in 1869. Her pony truck was built by the C. P. road in 1884, and her rear truck by the M. F. G. Co., in 1874.

"Her boiler has a 33-inch barrel, and is 8 feet 4 inches long, containing 111 2-inch flues, the fire-box is 2 feet 8 inches long, 4 feet deep, and 22 inches wide.

"The link hanging to her stack is to hold the trap up to let her breathe. There is no sand-box used. She weighs, car and all, 21 tons with her tank full of water, 750 gallons, and 800 pounds of coal on. Her caboose carries 26 passengers.

"Her first running in California was on the Market street road in San Francisco, where she ran from Vilincia street junction to Point Labos; this was in 1872. In 1884 she was running on the Vacaville road, and went from there to the Oroville road.

"She was brought to Sacramento for repairs, in 1884, and then went to run on the Visalia road from Goshen to Visalia. She was condemned and discarded in 1886, but in 1888 they commenced to build the road from Tulare to Visalia, and 'Old Bets,' again found herself in harness.

"In 1889 she was bought by the San Joaquin Valley Coal Mining Co., and she still bears their initials.

"She has pulled 18 loads, and on a grade of 18 feet to the mile she does very well with 8 loads. The grade up to the mine runs from 112 feet up to 170 feet per mile, she takes three ordinary loaded cars or two 50,000 pound cars up this grade at once. She is very quick, slips some going up, *but never slips running down hill*, like some you have mentioned.

"When on the Vacaville road she ran 11 miles in 13 minutes, with a ten-ton car of water, and stopped for sheep at that. She struck a flock later, and killed 27 of them, but 'Old Bets,' has never killed or crippled a human being."

Specimen of Conglomerated Rolling Stock.

Some Show of Economy.

The Pennsylvania Company make out a fuel sheet for the New York division each month; this sheet gives the amount of coal per car per mile that the company expect the men to run with. When the engine crews run for less, the company take half the saving and divide the other half between the engineer and fireman, the men receiving sixty cents per ton each for fuel saved. Last month Engineer Hartman, who runs the Webb compound twenty days per month, scooped in a coal premium of $23 75, his fireman getting the same.

This shows a saving of $95 in fuel for 20 days; had the other man done as well with her the other ten days of the month, she would have showed up a saving of $140 in one month.

This plan of the P. R. R.'s is the correct profit-sharing scheme to use on a road, and will pay any road to try. Some of the men running simple engines make good premiums, some less, others run above the limit set.

There are enginemen and enginemen.

An Example.

The value of signals and safety switches was well illustrated the other day on the Long Island road. A train ran by the signals at Newtown Creek—the draw was open—and the safety switch put them onto the ground. The best of signals without the safety switch would not have prevented a bad accident—we need all the safety appliances. The engineer and fireman were discharged. The L. I. use vacuum brakes.

Railroading in Jamaica.

Mr. J. E. Sague, General Master Mechanic of the Government Railroads on the Island of Jamaica, West Indies, recently gave us a call. Jamaica is an English colony, and the road is only some eighty miles long, employing fifteen engines. Both engine and train crews are colored men, and Mr. Sague pays his engineers a high compliment, says they are very intelligent—all read and write English and are anxious to read; he was getting copies of this paper to get up a club among them; he says that they compare favorably with any engineers; are sober and careful men. Mr Sague is here buying machinery for his road, he was formerly mechanical engineer of the Erie, and was also employed in the motive power department of the C., B. & Q. some years ago.

The Prussian State railroads have officially adopted the Westinghouse automatic air-brake. The Carpenter air and electricity brake was formerly adopted, but did not give satisfaction; 5,000 of them will be taken off—so say foreign railroad papers.

The railway mail service first began on Aug. 28, 1864, when postal cars were run on the Chicago & Northwestern road from Chicago to Galena.

Some Interesting Collision Tests in France.

In the last few months the number of passengers killed by the collision of railroad trains moving in the same direction has been exceptionally large, both in this country and in Europe. The most recent collisions of this kind in the United States were those at Ravenna, on the Erie road, and at Montezuma, on the West Shore. At the first of these, nineteen lives were lost, and at the second the number of the victims was eleven. It will be recalled that at Ravenna a passenger train standing at a station was struck by a following fast freight, which had no air-brakes, and to which the prescribed warning had not been given by the rear brakeman of the forward train. At Montezuma a freight train was struck by a following passenger train, and in this case again the warning required by the rules to be given to the following train was not given.

One of the worst of the collisions of this kind that have taken place in Europe was the one of July 26 at the St. Mandé station of the Vincennes Railway, four miles from Paris. Fifty passengers were killed and more than a hundred were severely injured. At the scene of this collision some very interesting experiments have been made, with the purpose of testing the assertions and explanations made by the engineer of the following train.

We do not know that experiments of this kind have ever been made in this country under similar conditions and with such a purpose in view. The story of the collision shows that two long trains were returning to Paris from Fontenoy, where there had been a musical festival. The forward train stopped at St. Mandé, and while it was standing there the following train struck it with great force. Four cars of the forward train were wrecked, the ruins caught fire, and some of the victims, while imprisoned in the broken cars, were drowned by the torrents of water poured on them by the firemen of the village. The engineer of the following train declared that after he saw the danger lights on the rear car of the forward train he was unable to stop his train because the air-brakes could not be applied to all of his cars. It was asserted by him and by another employe that the valve of the air-brakes between the fourth car and the fifth car had been closed, so that the brakes did not act upon the ten cars beyond this valve.

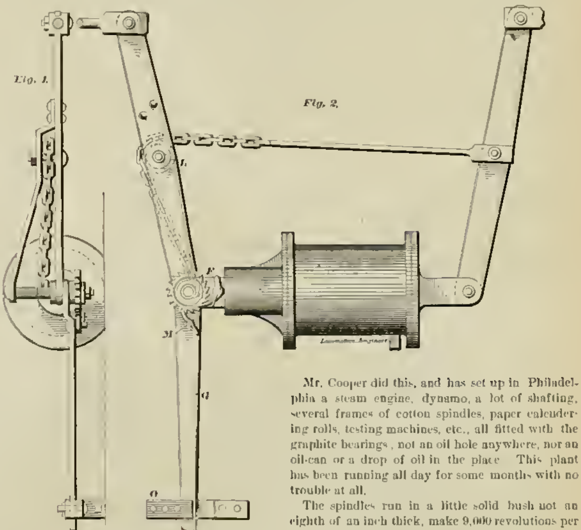
The experiments were made by the chief engineer of the railroad company, in the presence of a commission of State engineers. The following train had left the Vincennes station a few minutes before the collision took place. A train of the same length and weight was started from Vincennes by the engineers at the customary rate of speed, and the spot where the rear end of the forward train was standing at the time of the collision was marked by a stake which carried a danger light. It was found that this light could easily be seen by the engineer of the following train when he reached a point 853 feet from it. At that point the air-brakes were applied to the entire train, which was stopped in 131 feet, so that there were 722 feet to spare. In this experiment the steam had been shut off where it was customary to do this on a train approaching the St. Mandé station. In the next experiment the train left Vincennes under a full head of steam, and this time the steam was not shut off. The brakes were applied as before, when the danger light was seen, and the train was stopped in 311 feet. Here there were 542 feet to spare.

Then the engineers closed the valve between the fourth car and the fifth car, so that the brake would not act upon the ten following cars, and started the train from Vincennes in this condition. When the danger light was seen, the brakes were applied to the engine and the first four cars. The train was stopped in 443 feet. This indicated that there would have been 410 feet to spare, even if the engineer had told the truth about the condition of the brakes. The State engineers insisted that there should be one more test, in which the air-brakes should not be used. This time the only brakes applied were the hand-brakes, which acted only on the wheels of the locomotive. Under these conditions the locomotive passed the stake and danger light, but stopped only 46 feet beyond them. The engineers admitted that a collision under these conditions would have caused only an insignificant shock, for it is plain that the locomotive would have been moving very slowly at the point of contact. In none of the experiments was the engine reversed to assist the brakes.

By these tests the engineer appears to have been convicted of carelessness and falsehood. The official witnesses decided that the brakes did not fail to act on the day of the collision, and that "if the brakes had been applied, even tardily, the catastrophe would surely have been averted." To those who read the report of the experiments there seems to be no room for doubt as to the thoroughness and convincing character of them. But it is not probable that so painstaking an inquiry would have been made if a collision had occurred under similar conditions on one of our lines. The effect of the investigation was to place the responsibility clearly upon one man, and to show that the company had done its duty in the matter of equipment. It seems to us that the company was well paid for its work.—*N. Y. Times.*

Automatic Slack Take-up for Air-brakes.

Quite a number of schemes for taking up the slack of the brake rigging under cars have been invented of late, one of the most ingenious and simple of which is illustrated herewith. It is the invention of Mr. Alfred P. Riggs, an employe of the Colorado Midland road, at Colorado City, Colo.



As will be seen by the engraving, he employs a short shaft or spool, and a ratchet wheel, to take up the slack of the brake chain.

One lever, *G*, is pivoted loosely to the piston of the brake, and carries the pawl *M*; the other end is pivoted to the frame of the car by a bracket *O*. The brake chain passes over a roller at *L* on the floating lever, and to a permanent connection on the shaft. There is another pawl on the piston head *F*, that serves to hold the ratchet from moving backward at all.

When the brake is applied the inner end of the lever *G* is carried ahead, and if there is an inch too much travel the pawl *M* drops into another notch, and revolves the ratchet just that much, giving the pawl *F* a new "bite." Thus it will be seen that this simple device will take care of the slack occurring from the wearing away of the brake shoes or other causes.

There is now under construction a narrow-gauge road connecting the Oraya road, in Peru, with the mines of the Galena summit. It will reach an altitude of 15,850 feet—the highest in the world.

A New Friction Material.

Some years ago a maker of turbine water wheels, named Holmes, of Gardiner, Me., was experimenting with different substances to find a satisfactory bearing, or step, for water wheels, said bearing to run under water, and without oil. Among other things tried was a bearing of wood pulp hardened in molds under great pressure. This gave encouraging results, and he experimented with it further, finally mixing with it a small quantity of graphite. These bearing blocks were found to be hard and to run well, and were tried in other places, and under other conditions in the shop. The result has been something of more than passing interest.

Graphite is known to be a wonderful lubricant, but has generally been used with oils or other fluids. Holmes made bearings with greater percentages of graphite, using the wood pulp for strength, and soon found that no lubricant was needed at all. He put bearings made of this material to work in various places, with no means of oiling, and had no trouble with them. Some Philadelphia capitalists becoming interested, they employed J. H. Cooper, an old and well-known mechanic, formerly superintendent of the Southwark Foundry and Machine Company, to investigate the matter.

Mr. Cooper did this, and has set up in Philadelphia a steam engine, dynamo, a lot of shafting, several frames of cotton spindles, paper calendering rolls, testing machines, etc., all fitted with the graphite bearings, not an oil hole anywhere, nor an oil-can or a drop of oil in the place. This plant has been running all day for some months with no trouble at all.

The spindles run in a little solid bush not an eighth of an inch thick, make 9,000 revolutions per minute, and do not heat or cut; the bearings all look oily and polished.

The material can be turned, bored, drilled or planed just as metals can.

Should this material prove after trial to be adapted for bushings for valve motion work, solid-ended rods or crosshead gibs, it might make a great difference in the cost of running locomotives, to say nothing of gain, if it can be used, for car box bearings.

The saving of oil is far from being the only gain, as, so far, it has been impossible to measure the wear of any bearing used, and some of them have run over two years.

The writer spent a couple of hours in the place, and could see no trouble with the bearings then running.

The parties who control this invention do not claim the earth. When asked how it would work for car bearings, they said they did not know, they tried one bearing on an oil tester, where it worked all right, but it had never been in actual service under a car.

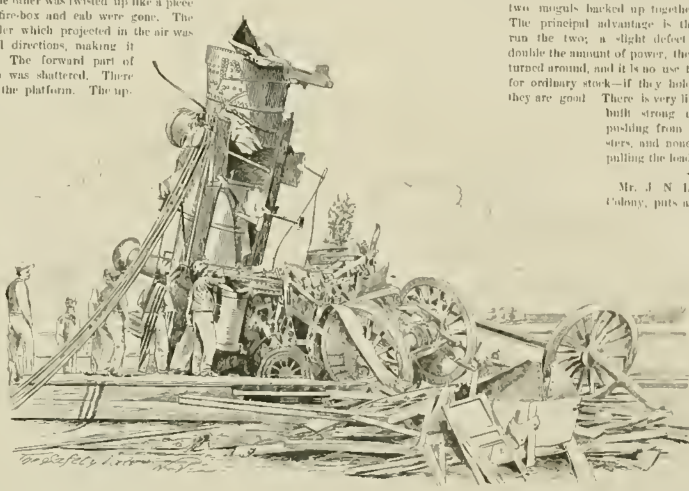
Brake tests are in progress all the time here, the graphite showing about one-third less friction than the best oiled metal bearing of the same size.

If the material cannot be used for railroad purposes it has a wide field of usefulness in textile machinery, where the absence of oil is of great advantage. It is the most promising "find" that we have heard of in mechanics for some time.

A Locomotive Boiler Explosion on the Long Island Railroad.

On Wednesday, Sept. 9th, the Long Island Railroad train No. 6, scheduled to leave Oyster Bay at 7.08 A. M. for Long Island City, and consisting of engine No. 113, a combined baggage and smoker and two passenger cars, was standing in front of the station awaiting the signal to start, when there was a terrific explosion. Conductor Jones stood on a platform near the forward part of the train with his watch in his hand, waiting to give the signal to start. Brakeman Michael Mahoney, who had borrowed a tool off the locomotive, swung himself on the tender to replace it. Engineer Donaldson was in the cab and Fireman Dickinson was preparing his fires for the run. Steam was roaring out the safety valve, and men and engine were only waiting Conductor Jones' signal.

Without warning of any kind the explosion came. The rear of the locomotive seemed to rise and open like a mammoth mortar, and big pieces of iron and three human bodies were shot high in the air, enveloped in a cloud of fire and steam. The explosion left the locomotive standing on its head, as shown. The driving wheels on both sides were shattered, and one of the driving rods was snapped in two, while the other was twisted up like a piece of rope. The fire-box and cab were gone. The end of the boiler which projected in the air was split out in all directions, making it funnel-shaped. The forward part of the tender also was shattered. There was a rush to the platform. The upturned locomotive told the story. Near by lay Conductor Jones, almost unconscious. He soon recovered. Brakeman Mahoney was found dead in the rear of the train. He was thrown directly back over the roofs of the three cars. Every shred of clothing was torn from his body, which was riddled as if by a discharge from a Gatling gun. Engineer Donaldson was found dead in a clump of trees about 100 feet from the north side of the locomotive. Fireman Dickinson was found a short distance away, on the south side of the engine. He lived about ten minutes. His skull was crushed.



The fire box was found with pieces of the cab 120 feet away from the south side of the wrecked locomotive. It was embedded deeply in the ground. Other pieces of the wreck were found scattered about. They included a number of the tubes out of the boiler. The shattered crown sheet of the boiler was found near the dead engineer's body. Near by lay the iron extension of the cab, which was turned inside out.

The frightened passengers left the train and crowded into the depot. The crown sheet of the fire box of the engine, with a portion of the cab, was thrown more than 150 feet, while other pieces of boiler plate were found more than 500 feet away.

The two front windows in car 125, which stood next to the tender, were shattered. No other damage was done to the train.

A wrecking train soon arrived, and by noon business on the road was resumed as usual. The real cause of the accident is unknown, and will probably never be learned. The railroad people say locomotive 113 was well built and in thorough repair. It was a powerful locomotive, and was run on express trains only. Master Mechanic Thompson, of the railroad, says the engine was thoroughly repaired in the company's shops at Morris Park six months ago. It was washed out in the shop Tuesday, and the flues cleaned. From the nature of the explosion it is thought to have been caused by the water running low in the boiler.

Locomotive No. 113 was built by the Rogers Locomotive Works in 1889, was one of seven forty-six tonners intended for the heavy summer traffic, and was run for two seasons on the main line. Early this year it was taken to the Long Island shops and thoroughly overhauled. Superintendent of Motive Power Charles Thompson, who accompanied the wrecking train to the scene of the explosion, after viewing the wreck, said in answer to my inquiries:

"I cannot tell anything about it. The explosion was evidently in the fire box, which is completely blown out. I do not think it could be due to any carelessness on the part of the engineer. Jim Donaldson was one of our best and most reliable men. There may have been some defect in the plates which could not be discovered during the overhauling. Whatever it may have been, the boiler was certainly sound enough to stand the full test to which it was put just before leaving the shops in the spring."—*Safety Valve.*

The first glass water gauge was used by James Watt, in 1780.

M. C. B. Standards.

The letter ballots on adoption of standards for the Master Car Builders Association are in, and the system of lettering freight cars; the plan of joint inspection, the form of joint inspection agreement, and the rules governing joint inspection, the form of report of defective cars received and delivered, and the joint inspection defect card have all been rejected.

The change of standard pins from $1\frac{1}{4}$ to $1\frac{1}{32}$ for air-brake rigging, rescinding the Fletcher lid as standard; the box bearing wedge and lid for 60,000 pound cars, and the new lid for old standard journal-box were adopted.

A great deal of thought and labor were expended in revising the interchange rules, some of which has been lost.

There are quite a large number of Fairlie engines at work in Mexico, these are of the double-end, four-cylinder type. Mr. Johnstone, Supt. of M. P. & M. of the Central Mexicano, has asked for bids in this country for six large engines something similar to the Fairlie's, they are to be compounds, have 12 drivers, be articulated, and weigh 230,000 pounds, 200,000 of it on the drivers. These engines will be something like two moguls backed up together, without tanks. The principal advantage is that one man can run the two; a slight defect in one lays up double the amount of power, they don't have to be turned around, and it is no use to inspect bridges for ordinary stock—if they hold up under them they are good. There is very little rolling stock built strong enough to stand pushing from one of these monsters, and none of it can stand pulling the load they can handle.

Mr. J. N. Lauder, of the Old Colony, puts a heavy iron hook on the inside beams or frame of his iron-framed tanks, and just over the transom of the truck, four hooks in all. When these tanks get off the track, and have to be jacked up, they put chains around the truck transom and over the hooks, then when they jack up the tank frame they pick up the truck too. Without this you simply lift your truck frame, leaving the heavy truck half buried, and in such shape that you dare not try to pull it on, for fear of knocking the frame off the jacks. These little tricks save lots of money when there is a "circumstance" on hand, and practically cost nothing.

An official of the Richmond & Danville road sends us a $10 bill, ten names, and the following note: "After reading your piece entitled, 'Circulation Liars—For Advertising Only,' in the August number, I could not help calling on a few of our 'dirty greasy' engineers who have access to and wear my paper out, to chip in a dollar apiece, and I would send on the list. I think I called on eleven, and ten of them gave me a dollar for an answer. The following are their addresses, to which please send THE LOCOMOTIVE ENGINEER for one year, beginning with September."

Master Car Builders Committees for 1891–1892.

Secretary John W. Cloud announces the subjects and the committees for the next meeting of the Master Car Builders, as follows:

1st. Joint Inspection—To prepare a supplementary set of interpretations and illustrations of the Rules of Interchange.—Committee: A. M. Waitt, H. C. McCarty, F. D. Adams, Wm. Gar-tung, Joseph Townsend, J. T. Chamberlain, D. W. Hunter.

2d. Air-brake and Signal Instructions—To review the instructions proposed at last convention.—Committee: E. W. Grieves, R. D. Wade, J. L. Greatsinger.

3d. Cast-iron Wheels—To investigate what improvements are being made in the manufacture of wheels, so as to secure greater uniformity in quality, in depth of chill and in distribution of metal for proper balance.—Committee: Geo. W. West, W. H. Thomas, John Player.

readily removed and another substituted in its place.—Committee: J. N. Barr, J. C. Barber, W. H. Lewis, T. A. Bissell, J. W. Marden.

7th. Steel-tired Car Wheels—To report upon relative merits of solid cast and wrought centers, and of plate centers bolted to hubs and tires.—Committee: R. E. Marshall, J. O. Pattee, C. H. Cory.

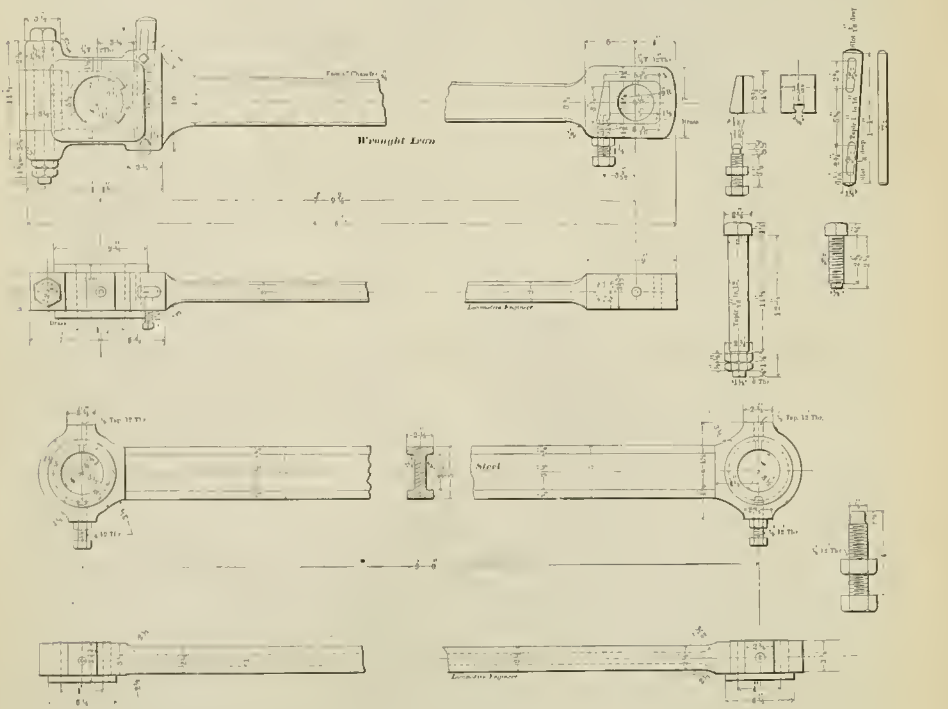
8th. Wheel Guarantee—To consider the communication from the Wheel Manufacturers' Association, read at last convention, and to report with recommendations.—Committee: J. J. Hennessey, Thomas Sutherland.

9th. Steel Plate and Malleable Iron in Car Construction—To recommend a standard for stake pockets, and a method in detail for attaching to cars. Also to recommend standards for center plates, in detail, showing one for iron transoms and one for wooden transoms. Drawings and models to accompany the report.—Committee: William Forsyth, John Mackenzie, E. D. Bronner.

10th. Standards of the Association—To consider

are we fail to see. It is certainly expensive, and in case of a break in the strap or fork, calls for expensive forging and machine work on the rod. Our personal experience with the rod was confined to one day's work—a very cold day, by the way—being sent to disconnect an engine badly wrecked by a rear collision. We found one rod on the forward dead center, and the truck in such a position as to prevent lowering the forward end if taken down, and we couldn't get it down. If the main rod had a strap on the back end we could have driven it off and got the rod down—but one swallow does not make a summer. It will be noticed that keying at either end of this rod tends to lengthen it. This style of rod is becoming very popular, notwithstanding.

James Heron, one of the best foreman boiler makers in this country, will leave Chicago when a favorable opportunity presents itself. Mr. Heron is an organizer and a specialist in his business. His present address is 5040 State street, Chicago.



C., R. I. & P. Rods

4th. Freight Car Truck Frames—To report upon the relative advantages of swinging and rigid bolsters and upon the Fox pressed steel truck as compared with the prevalent forms of freight car trucks.—Committee: G. F. Wilson, W. S. Morris, W. F. Turreff.

5th. M. C. B. Automatic Coupler Standards and Limits—To consider the standard measurements, and whether any additional or other measurements are desirable as standard, and to report upon proper limits of variation to be allowed from standard measurements.—Committee: J. S. Lentz, C. A. Schroyer, J. M. Wallis.

6th. Steam Heating and Ventilation of Passenger Equipment Cars—To report upon the general progress and the efficiency of different systems, and to present drawings for a proposed standard location of ends of train pipe, and a proposed standard connection in detail for a union between the hose and pipe, so that one style of coupling may be

the standards already adopted by the association, and recommend what measures are expedient to secure their general adoption and use.—Committee: R. H. Soule, E. Chamberlain, William McWood.

11th. Metal for Brake Shoes.—Committee: G. W. Rhodes, E. B. Wall, George Gibbs.

Details of Rods—C., R. I. & P. Eight-wheeler.

The accompanying illustration shows the rods used on the C., R. I. & P. engines illustrated last month, and gives detail measurements. The solid ended steel rod of I-section is now used on the majority of new engines built in this country, and is a much-needed improvement over the old strap rod.

The main rod is of a form known as the "Pennsylvania standard," having a solid fork at the crank end, and a block behind the brass, held by one large bolt, this rod appears to be very popular with our designers now, but just where its advantages

Asphyxiated in a Tunnel.

Engineer Jack Rochefort, of the through express, south-bound, S. P. road, on July 30, met death in an unusual manner in Tunnel 14, sixteen miles south of Ashland. Two engines are required to take the train over the Siskiyous. Rochefort had the front engine. When the train was nearly through the tunnel, the coupling between the mail and express cars broke. Twenty minutes were consumed in making a new coupling. The smoke and gas from the second engine blew directly into the cab of the one ahead. It was decided to back out of the tunnel, and when the train stopped outside, the engineer and fireman of the front engine were missing. Search revealed the engineer lying dead by the track, with his arm cut off. Fireman Fitzpatrick was lying unconscious by the track, but revived half an hour later. Both got off the engine to escape suffocation, and were asphyxiated before they reached the ground. Rochefort fell with his arm across the track, and bled to death when it was cut off.—*Daily Paper.*

Tunnels are dangerous places to stop to fix any thing: they should have backed out at once.

A Boiler Kills Four Men.

A locomotive explosion occurred on the Central Railroad of New Jersey last night, near Nesquehoning Junction, Pa., by which four men were instantly killed Yard engine No 335 was shifting freight, and had just passed out of the yard, in which there were several other locomotives and crews. When it reached Nesquehoning the fire underneath the engine boiler was noticed to be dying out, and giving off a quantity of vapor. Fireman Pope got down from the cab to examine the boiler. Instantly a violent explosion occurred. The four men who were on the engine were blown in every direction. The fireman has not been found yet.

The names of the killed are: Engineer Thomas Tripp, Mauch Chunk; Fireman J. Pope, Linsford, Brakeman Gallagher, Mauch Chunk, Brakeman Smith, Mauch Chunk.

The body of Engineer Tripp was found more than 100 yards away. His body was bruised and crushed. The brakemen were found in an opposite direction, and must have died almost instantly. The engine was totally wrecked, the boiler landing upon the mountain fully 300 feet from where it had stood.—*Daily Paper.*

If all four men on this engine were instantly killed, who noticed that mysterious vapor when the fire was dying out? The average newspaper reporter, in his constant endeavor to supply something exciting or mysterious, startling or shocking, seldom fails to put something into all his work that is purely imaginary. We were once running second section to a train that was wrecked and the engineer killed. The skeleton dispatch sent out stated that train three struck a washout near such a station, and Engineer Albert was killed. The papers all had different reports—one told how "the brave engineer stood at his post, a look of determination on his face and his hand on the throttle." No one saw the engineer; the fireman was on top of the tank and jumped from there before the washout was struck. Newspaper reporters have a propensity for having engineers die with their hands on the throttle. The simple, awful truth, with no glamour of heroics thrown about it, might do some good. Engineers and trainmen are sacrificed every day because of the greed of stockholders or manipulators in demanding dividends and not supplying safety appliances. There is nothing heroic or grand about murder—murder is revolting, no matter who commits it or how fearlessly it is endured by the victim.

Points from the Rio Grande Western.

Major Dailey, master mechanic of the Rio Grande Western road at Salt Lake City, has a small shop fairly well equipped with tools.

This road, like its parent, the Denver & Rio Grande, was formerly a three-foot gauge, but has been widened out in the past year. Some of the branches are still a yard wide, but the main line is now all standard.

The new equipment is good, and up to date, the cars are modern and well finished, lighted and heated.

Passenger engines are mostly ten-wheelers of the Rome build, and are nice working engines, except that they appear to be made of poor material, for they wear very fast. Engines that have regular crews, and had been in service only four months at the time of our visit, had worn their valve seats clear down, and had false seats.

Eccentric straps wear out in a few trips; they don't appear to cut, but wear much the same as you would expect them to do if made of lead. The hubs of driving wheels and sides of boxes wear very fast, and to a great extent in a remarkably short time.

The men are held in a great measure responsible for this, and, as there are no restrictions about the use of oil, they pour it on in copious draughts—and who can blame them? We never saw engines that got more oil, or got it oftener.

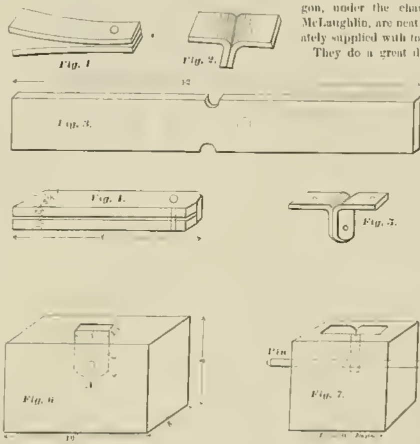
The road has very heavy grades on its eastern end, but the west end around Salt Lake runs through a garden for miles and miles.

In the shop we noticed a home made press that is of great utility, and one that would soon pay for itself in any shop, great or small.

A heavy table some four feet long, and perhaps thirty inches wide, of cast iron, is the foundation: each side of the center of this table there are bosses that carry the uprights, which are 3 inches in diameter and about 24 inches high, these are connected at the top by a heavy wrought-iron cross-beam, the whole resembling a copy press on a large scale, except that in place of a screw they use a hydraulic jack. For this purpose they use a 20 ton Dudgeon turned upside down, and fastened in the crosshead or beam, the weight of the ram being counterbalanced by weights. The table is planed up true and laid off with one-inch divisions each way, for convenience in straightening work.

This is used for all purposes any press can be, pushing in and removing bushings from bearings, etc., and for straightening work. It is much more convenient than a screw jack, far more powerful, and quicker, while one man can handle it to its full capacity.

The Old Colony Railroad have an iron jib crane at the Roxbury shops that is interesting. This crane was made in Liverpool, England, and shipped to Roxbury in 1836. It was not set up until 1850, and has been in constant use ever since for general shop purposes within its capacity, which is probably five tons. A mechanic who was about to build a new crane recently, examined this old-timer, and declared that the general features were no different, and fully as good as the average practice of to-day, of course the details of hoisting gear have been somewhat improved.



CROW FEET

Cheap Plan for Making Crow Feet.

Crow feet, the blacksmith's part of a boiler, have been used from the days of Watt to this, and the usual manner of making them has not improved very much since that time either.

In the splendid boiler illustrated in our last issue, built by the C., R. I. & P. road, there are employed some 46 crow feet. James Heron, foreman boiler maker there, used the regular crow feet, and made them in the usual way, by cutting up bars of Ulster iron ¾"x2½" into lengths of 7", and then welding the ends of two pieces together, as shown in Fig. 1, then they punched an inch hole in the welded end while hot, and then bent back the ends, forming the completed crow foot as shown in Fig. 2.

These pieces weigh about 6¾ pounds, and at 4¾ cents per pound have about 31 cents worth of material in them. Then the blacksmith gets 14 cents each for his work, and you have for 46 a bill for material of $14.26 and $6.44 for labor, making the crow feet cost $20.70.

Mr. Heron devised a "kink," and used scrap steel that was otherwise wasted, being too heavy for patches; he makes crow feet so that the labor costs but 1½ cents each, and certainly gets a far stronger foot.

Scrap from new boilers is cut into strips 2½" wide and 12" long, using material ⅝" or 9/16" thick. These strips are punched as shown in Fig. 3, these holes are 1⅛" in diameter, the side holes being about three-quarters full, so as to make the piece bend readily, and dispense with the necessity of cutting corners off the completed piece, leaving the piece like Fig. 4. These strips are bent, and a 1" barrel drift-pin is driven through the holes, thus bringing the holes fair in the two pieces, and leaves a clean, smooth hole, which is not the case in the old hot punched crow foot.

Mr. Heron then places the punched end of his double bar in a recess made in a cast iron block, as shown in Fig. 6; this block is 8"x10", and the slot is 1¼" wide and 3" long. When the piece is dropped into the hole a pin is put through a hole in the block and the hole in the piece, and a spreader and a blow from a hammer spreads the toes out and completes the foot.

All this is done at one heat, and all crow feet are made of a standard size. A boy can bend 300 in a day.

Some 20 years ago Mr. Heron used a kink something like this at the Baldwin works, and has used different modifications of it since.

An Item from an Oregon Shop.

The shops of the U. P. Ry.—the old Oregon Railway and Navigation Shops—at Portland, Oregon, under the charge of Master Mechanic D. McLaughlin, are neat and cleanly, but only moderately supplied with tools.

They do a great deal of heavy work for their steamers on the Columbia River and the coast, and keep up repairs on a great diversity of locomotives.

There is a foundry and blacksmith shop, both far too small, and a pretty fair machine shop.

All the buildings are of brick, and are good so far as they go.

The road in this locality is mountainous, but there seems to be an awful lot of small engines in service, and these are not very new or very good, either. With modern power a great improvement could be shown in the operating expenses.

The shops were being whitewashed when we were there, and otherwise cleaned up.

They put on air-brake hose fittings with compressed air, using a freight brake cylinder without attachments of any kind to it. The hose is held in a groove between two oak planks that are hinged together at the back and clamped by cams in front. Between the clamp and the cylinder there is a wooden stick, probably four inches square and three feet long; it is hinged at the back, some two feet from the cylinder, and the other end terminates in a handle. The vise has two grooves in it, and two pieces of hose can be put in at once. fittings are entered by hand, the lever brought up against them, and air turned into the cylinder, forcing them home. We have already mentioned the method of cleaning coaches by air jets employed here.

The Deadly Parallel.

The following notices recently appeared opposite each other in a railroad paper. Of course they are both correct.

The Brooks Locomotive Works, Dunkirk, have built a compound locomotive for the Lake Shore & Michigan Southern. It is of the two-cylinder type—cylinders 17 and 29x24. It is a 10-wheeler and has made some trial trips in freight service.	The Brooks Locomotive Works, Dunkirk, N. Y. have just built their first compound locomotive, and it is now running on the Lake Shore road. The engine is a mogul with one large and one small cylinder, intended for freight service. The cylinders are 16 and 29x24.

Locomotive building is quiet, no shops being crowded with orders.

Recent Fast Runs.

The Bound Brook division of the Reading has always been noted as a good place for a fast pace; but the story told of a run on August 27 with four cars, by the Wootten boiler engine 206, 68-inch wheels, of a mile in 39⅘ seconds, beats all previous records and is very hard to believe, although we are personally aware that a mile has been made there in fifty seconds and less

On September 14 a special train went over the N. Y. C. & H. R. R. from New York to Buffalo—436½ miles—in 439¾ minutes; counting three stops—one for eight minutes—actual running time was 61.44 miles per hour; including stops, 59.52 miles per hour. The best run was with an engine having 78 inch drivers; she made 150 miles in 140 minutes actual running time. It is altogether likely that the Central Hudson will put on a train guaranteed to make a mile a minute over their line, and all the roads between here and Chicago will have to do this, in self-defense for the World's Fair in 1892.

We have plenty of engines and plenty of engineers for this kind of work, but we have no roads with a track or signal system that are safe to make it on every day in the week.

Positive block signals are needed to-day the worst of anything on our double-tracked roads. Automatic brakes on all freight trains are necessary before any passenger trains on single-track roads are safe.

Four-cylinder Locomotives.

Under the heading, "Give credit where credit is due," Mr. Henry F Shaw, designer of the Shaw engine, writes us protesting against the publication, in another paper, of an article crediting Master Mechanic Richards, of the Reading, with proposing a four cylinder engine for fast speed. The four cylinders are supposed to, and probably do, do away with the necessity for counterbalance.

Mr. Shaw's engine, as almost everybody knows, has four cylinders, and she ran under Mr. Richard's care. Mr. Shaw seems afraid that some one will get credit that is plainly due himself.

Four cylinder—or rather four steam engines, complete have long been used experimentally for locomotives in different countries, but their care and cost always stood against them. Railroads have generally discarded them, on the principle that "of two evils choose the lesser." We don't believe any one wants to steal Mr. Shaw's credit for the complication.

Using four engines to get rid of the counterbalance reminds us of the old story of the quack doctor, who, when a patient came to him claiming to be afflicted with insomnia, said "That's a bad disease and I don't know much about it, but I'll tell you what I'll do, I'll give you some stuff that will throw you into *fits*—and *fits* is my specialty!"

The Houston, East & West Texas and the Shreveport & Houston Railway Companies are under one management, and our correspondent, E A Campbell, is Superintendent of M P. and Machinery. The road is narrow gauge, 282 miles long, using 16 locomotives. We notice from his monthly service sheet that the engines averaged for the month of July 51$\frac{1}{10}$ miles to a ton of coal, and the wood burners made 45$\frac{7}{10}$ miles on a cord of wood; 27⅘ miles were averaged to a pint of oil, and 32¾ to a pound of tallow. That's pretty good service.

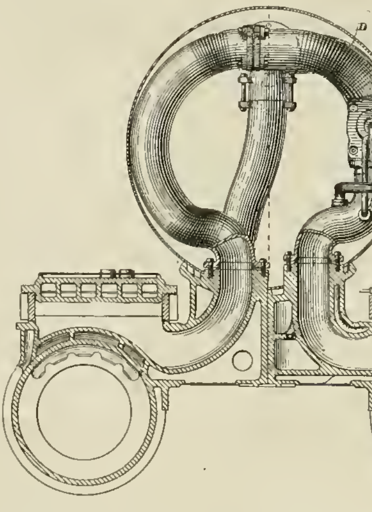
Mr. William C. Stroud, one of the members of the firm of Burnham, Williams & Co., proprietors of the Baldwin Locomotive Works, died on Sept 21st, at Rosemont, Pa. Mr Stroud was only fifty-three years of age.

The Dean Compound.

The new compound locomotive on the Old Colony road is in service. She is running light trains yet until she gets "broke in," but shows that she is ready for business even now. This engine is of the two-cylinder type, her high-pressure cylinder being 19", and the low pressure 28" by 24" stroke.

The high-pressure cylinder is steam-jacketed, and especial pains have been taken to prevent condensation.

Our large engraving shows the arrangement of the front end. Steam goes down the single steam pipe *D* to the high-pressure cylinder, and at the same time enters the small pipes to the valve shown upon the side of the arch; there it moves a piston and enters the receiver and steam chest of the low pressure cylinder by a small pipe, applying boiler pressure direct to the big cylinder to help start the engine. As soon as the high-pressure cylinder exhausts into the left pipe, Fig. 2, it lifts the swinging or clack valve, and flows to the low-pressure cylinder, through the receiver at the same time it enters the operating valve chamber, operating on a larger piston than did the live steam, and shuts off its supply of steam from the boiler. The steam from the low-pressure cylinder exhausts directly into the stack. The receiver pipe is double, and flattened out, to present a large area of heating surface; it is also covered with projecting rings of metal, to absorb and conduct heat.



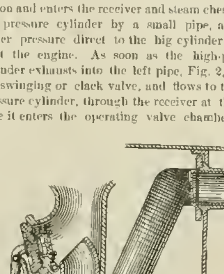


Fig 2

There is considerable of a slam when the intercepting valve shuts down, but that can be easily cushioned. The engine almost invariably slips when she starts, showing that she gets lots of steam into that big cylinder through that inch-and-a-half pipe.

The engine is Mr. Lauder's well-known plain, black, business-looking machine. She weighs 112,000 pounds, 66,000 of it on the drivers. This leaves a pretty heavy weight on the truck, due to the enormous cylinders, but Mr. Lauder has provided for that in a measure by getting in 38 steel wheels with a very large journal bearing, which he can increase to 6x8 if there is a disposition to heat. The engine gives promise of doing exceptionally good service.

Mr. Dean, the inventor, has designed a two-cylinder compound, now building at the Wilkes-barre shops of the Lehigh Valley, that will run in competition with a Baldwin four-cylinder compound of the same weight and capacity. This trial may go a good way toward determining the future design of compound for this country, as the question must eventually be settled by the survival of the fittest.

A Fairy Story.

The following item is floating around the press. Its "no smoke-stack" part reminds one of the story of Sam Slick's patent cook-stove:

"The Chicago, Milwaukee & St. Paul Railway Company is building, at its Milwaukee shops, two new engines which promise a revolution in locomotive building. The new engines consume their own smoke and have no smoke-stack. They are fitted up with an electric headlight, which is placed on a stand immediately in front of the boiler, thus giving the engineer an unobstructed view of the line ahead. The drive wheels are larger than on the ordinary locomotive, and intended for greater speed. The new engines are particularly designed to furnish power for lighting passenger trains with electricity and for furnishing steam heat. These engines will be used on the track between Milwaukee and Chicago, and it is intended to reduce the best time now made by one hour at least." The interesting part of the story is that the St. Paul folks are not building such an engine.

Describing a Crank.

Everybody who has had an encounter with Conductor Griffith, of the Lackawanna, will enjoy this story from the Dover *Index*: "An old and well-known conductor on the D., L. & W. Railroad has become noted among the patrons of that road for his solicitude to protect the interests of his employers in taking up tickets, and the lack of memory displayed when he demands tickets from persons who have already surrendered them to him. On a recent occasion he approached a young man of Rockaway with such a demand. The young man had passed through the same experience once before, and consequently had taken precautionary measures to prove that the conductor had received the ticket. After remonstrating with the young man several minutes, and accusing him of trying to beat the railroad company, the conductor finally threatened to stop the train and put the young man off. This was as much as the latter would stand, and Goodale said to the conductor: 'I gave you a marked ticket, and you will find it among the tickets in your pockets.' The conductor, who, by the way, is named Griffith, took out the tickets, and holding them in his hand, inquired: 'How was it marked?' The young man promptly answered: 'It was marked, "This conductor is a d——n fool."' Among the laughter of the other passengers 'Old Griff' found the ticket as described and angrily left the car."

Correspondence

Wants to Know About that Strainer in Train Pipe.

Editor The Locomotive Engineer:

In reading the article by Mr. T Paxton, on "Danger in Testing Brakes from Rear of Train," published in the September issue of your interesting paper, a question occurred to me which I should like to have Mr. Paxton answer.

In what part of the main train pipe is the strainer, against which he says the waste was pressed in such a manner as to prevent the passage of air?

PAUL SYNNESTVEDT,
Gen'l Air brake Inspector C. & N W Railway.
Chicago.

On Hood's Eccentric Question.

Editor The Locomotive Engineer:

I have read with a good deal of interest all the correspondence respecting Mr. Hood's running his engine with three eccentrics, without thinking of entering the list till I read his last letter, when I thought I would like to suggest a few thoughts on the question respecting the oscillation of the link with the back-up eccentric disconnected, and its effect on the movement of the valve. I would say that it depends largely on the pattern of the link Some builders make the link with the fork ends of blades coupled to the *ends* of link, so that the center of bolts of the fork ends are on center of a radius line running through center of link, and, of course, through center of link block, so that some inches intervene betwixt the centers of the two pins of fork end and block when the lever is in full gear I would ask Mr. H if he would feel safe to run an engine with such a link with three eccentrics.

I wish also to enter another query for the Reading Engineer as to his remark that by running with his back-up eccentric off, he threw the strain of two eccentrics onto one, which, I judge from the tone of his letter, he thought a serious matter. Now I knew an engine that run a number of years —and the owners and builder were very proud of her —that had but one eccentric to run both engines both ways (ahead or back up); this engine was in the exhibition at Chicago, in 1883.

I suppose "Reading Engineer" would say that this engine threw the strain of four eccentrics onto one. It is true that one did the work that most engines have four to do.

R. J. C
Marquette, Mich.

A Typical Letter from the Inventor of the Keely Motor.

Editor The Locomotive Engineer:

Some time ago there appeared several articles in your paper in regard to the extinguishment of the lights at several stations, on the arrival of certain locomotives, due to the vibrations caused by the sound of their whistles. A short time ago I mentioned the circumstances to Mr. John W Keely, who gave me the following theory of the cause spoken of.

W. B L. V.

"Theorizing on the condition necessary to bring about to induce molecular antagonism as between the radiating action of an illuminated center of theorem as activity, and sound force emanating from the whistle of a locomotive to induce neutrality or its extinguishment (the lights), the question arises, What are the conditions—the true philosophical ones —that govern such evolutions?

"All such conditions are brought about by the outreach of an antagonistic wave induced by sound or otherwise of differential lengths, as one to three, as between the one and the other from their radiating centers during activity, and are principally governed by the combination of chord masses by which they are immediately surrounded, such chord masses in combination may represent a resonating force as between the two agents as one is to three, the one on the majority subverting or overruling the one on the minority, and thus that peculiar audible tone of the locomotive whistle by its two-third wave neutralizing the one-third wave of the lights, and thus extinguishing it; but such conditions are very rare in their occurrence, but are not at all paradoxical in their solution. They only prove certain sympathetic facts that will cease to be paradoxical in their evolution to the general mind, when the principles are understood by which such demonstrations are brought about.

"Volumes (and not a few) could be written on this subject alone, as it takes in a wonderful sympathetic range of volume that reaches out even into infinity, and is included in the sympathetic link that associates the celestial forces to the terrestrial outreach.

"The action of the locomotive whistle on the lights is only a repetition of what occurred before the walls of Jericho, but brought about in a different way. The causes are the same, as also the results"

KEELY
Philadelphia, Pa.

Double-crewed Engines—What are the Duties of Each Crew?

Editor The Locomotive Engineer:

Would you kindly state in your next issue, if in time, the duties of engineers who are double crewing one engine on a passenger run, that is, engine doubles the division every day. Myself and my opposite runner have only one engine in the place of two engines. Should either of us be held equally responsible for keeping this engine in shape, and what work should be expected by the locomotive department of runners who are double-crewing one engine, such as packing glands, cab, mountains, lubricators, setting up wedges, examining engine, headlight, trimming, etc., and all other small matters too numerous to mention, such as packing tender axle-boxes, and firemen coming on duty finding lubricators empty, and no stores on engine, gauge lamps not burning, etc This is a case of a night run.

ENGINEER.
Brandon, Manitoba.

[The question raised by our correspondent is one that needs some intelligent rules on any road where double-crewing is practiced. The very best plan is that in use on the Pennsylvania, there the roundhouse men do all the work, cleaning, packing, etc, the engineer will even report a wick put in gauge lamp on chain-gang engines. Most roads won't do this, at first anyway, and the men are usually left to shift for themselves The best plan we know of is for the men to agree and divide the work. Let one man do all the packing, set up the wedges, etc., the other to clean and keep in proper shape the headlight and all signal lights, keeping the tender packed, or any such division as can be fairly made, letting the work be done so as to have all lamps, headlight, etc., put in shape by the day man, and divide the work so as to take advantage of location or lay-over for each man. The firemen should divide their cleaning, one taking the cab, and the other the outside Supplies should be drawn where it is the least work. No hard and fast rule can be made that will be as satisfactory as an agreement by the men. No officer in charge of motive power should expect double crewed engines to be as well cared for or as clean as single crewed, unless he does this work by shop men.]

Information Wanted on an Injector Question, and Some Pointers on Balanced Valves.

Editor The Locomotive Engineer:

Just before my old mill went into the back shop I had considerable trouble with the right injector, and would like some good injector man to explain the trouble, it is a No. 10 Monitor. It got in the habit of not taking the water all up when it got low in tank, but would work all right with a full tank, but it gradually got worse, and finally refused to take it up with a full tank

Then it would work all right until about half over the division, when it would begin to "buck" again, and sometimes got so bad I had to shut it off and work the left one, which would not supply boiler, and would not work much better than the right one when the water was low, and, as I did not like to stop between stations and fill up, I had to do some pretty close figuring to keep the crown sheet wet.

I hunted for leaks, but could find none I oiled it regularly, took down hose, and did everything I could think of to locate the trouble, but failed. I reported it, and a machinist examined as well as he knew how, but everything appeared to be all right. I have done a great deal of thinking, but have not found out yet what the trouble was.

I also had trouble with the balance springs in right valve She got in the habit of breaking a spring every trip, and always did it coming down hill Generally it was the outside one, but sometimes she managed to break the inside one also. It was a regular thing when she came in to put in a new spring. The machinist's helper made the remark one day, that when the "Nine" came into the house the nuts on right steam chest would begin to work off themselves For my part I could not see what caused the springs to break. The engine had been running about two years and six months, and had worn quite a groove in the balance plate, and I first thought that was the cause of it, but after thinking it over I don't see how it can be. If the trouble was in the groove, why did she not break them going up hill as well as down? But the most mysterious part of it was, sometimes the oil would all blow through the hole in valve, and that side would get dry, no matter how much oil I used I have used a Detroit lubricator full, going fifteen miles, and it was just the same. And the next time she broke the same spring she would not get dry, although I used no more oil than when spring was in good condition. Now I have studied considerably on this, but cannot understand it I finally got tired, and tried to get the foreman to take the springs out and plug up the hole, but he refused. I thought it would be much better to run the valve "unbalanced" than without oil, and a big blow in it. Well, she will be out of the shop soon, and I am anxious to see if the springs will break after the balance plate has been planed off. Will some one explain this matter?

Aspen Junction, Colo.

J. W KAEFUS.

Examination of Enginemen on the C. & W. M. Ry.

Editor The Locomotive Engineer:

I met my old friend Doc the other day on our road going up north, trout fishing. We have got some of the finest trout streams in this State on the C. & W M. Ry. After a talk about old times and old friends he got around to the question of examination of firemen before promotion. We had a hot talk, both of us learned a few things—possibly Doc. learned the most. He said "This examination business is no good A man has got to have lots of experience and a good head to get along at all. Talk about knowing how to block up and disconnect in a breakdown, lots of machinists can take an engine apart and block up for all the breakdowns that ever happen to an engine, quicker and better than some engineers, because it is their business to know just how the machine comes apart the easiest way. Yet you would not trust them out with an engine on the road Trainmen know all about the questions asked on time card rules, but I would not let one of them touch my engine. You see an engineer nowadays has to know all about *all* these things just the same as he had to twenty years ago, asking him questions don't find out much about it. Our traveling engineer is examining the firemen before they are promoted, and I hear he is going to examine the engineers too after a while That is what works me up. I know how to get a train over the road in pretty good shape, but when it comes to telling how to do it I might get left. I hear you examine all the men on your road before promotion How do you do it? Do you ask them a lot of fool questions about lap and lead, motion curves, horse power of an engine, combustion, how many pounds of steam a boiler will carry, etc.? I would laugh to see some of these book engineers that can talk scientific and use big words get the old '93' over the seven mile hill on a bad night without doubling Then there is another thing about this examination business, lots of men that know all about it can't answer a dozen questions when they are called in the office, they 'get rattled'"

I answered Doc. something after this manner "Suppose it is a fireman's turn to be examined In the first place, look up the man's record and see if he has always been attentive to his duties, is clean and orderly, and has the reputation on the road of being careful and reliable. If he is all right in these points have a talk with him on the subjects you wish to examine him on, to find out how much he knows about them. If he is well posted, notify the master mechanic that Fireman Blank is ready for examination. As soon as convenient he is sent to headquarters, to the superintendent of motive power, who gives an order to examine him. He is not examined in the office, but we go down to the roundhouse and question him on all the breakdowns that are liable to happen to an engine. As all our engines do not have the eccentrics keyed on the axle, he is closely questioned on how to set a slipped eccentric the quickest and surest way, and why he does it that way. *A reason for each operation is asked.* Lots of questions about handling a train, about looking after an engine when off the track, stuck in the snow, or disabled, what to do with injectors when they don't work well, or won't work at all, and as most of our engines have air pumps and driver brakes, the examination on air is intended to be thorough. It takes two or three hours, is all oral, and right alongside the machinery we are talking about. If he passes successfully, any points he is not quite bright enough on he is posted about. Last May, when I found it to be a necessity to call their attention to facts about engines they should know, a list of questions was made up and written up in small memorandum books, which were passed around among the boys. There were no answers written in to any of these questions, as the idea was to call their attention and let them find out all these things for themselves, then they would know something. These books were issued to the firemen as fast as I could write them up at leisure moments, till now there are eight or ten copies out, besides those the boys copied off for themselves. The result has been good. You can see the young men (and some of the old ones) when they are off duty, looking around the shops seeing how engines are put together, getting down to bed rock in valve setting, finding out how air pumps and everything connected with the air-brake is made, and where it is liable to give out; in fact, posting themselves up on everything connected with their engines. We have a small link motion model or instructor, which any one can get to study on, or experiment with, any time they want it. They are spending some money on books like Forney's Catechism, Angus Sinclair's book, and lots of time studying them, and asking each other hard questions. They ask me questions every day, some of them hard ones."

Doc. kept quiet while I was telling him all this, but finally broke in, asking if I had one of those question books with me. He got it right off and settled back to look it over. I could see his nose turn up once in a while, as he went down the list, but before he got through he looked pretty sober.

He took the book with him. When he came back from his fishing trip he called in the office at Grand Rapids, handed it back, saying, "I am converted, I will tackle my fireman as soon as I get home, and brace him up for business so he will pass O. K." The September number of THE LOCOMOTIVE ENGINEER was on hand; I called his attention to the editorial on page 170, and to the ad. on page 171 about the book of examination questions and answers. Doc. said he had seen THE LOCOMOTIVE ENGINEER, but had never taken the trouble to read it. Then I opened up on him, told him he was in the same rut he had been in for fifteen years, that he must get out of it, "right away quick off," let go of his old-fogy notions and keep up with the procession if he did not want to get stepped on. *He will do it.* If studying on a list of questions about his locomotive will wake up an old fellow like him, what will it do for a young man anxious to get ahead?

I believe in examinations, the progressive kind such as Brother Hill has described in this paper. A man should be examined when first employed as fireman, to see that his eyesight is good—not on colored yarns or fine prints, but on objects near and at a distance, on switch lights and colored signals. He should be a fair writer, and have passed to the eighth grade in our common schools. At the end of his first year the traveling engineer should take him in hand—find out what he does know about an engine, post him up on what he should know. That will give him a start in the right direction, so he will post himself up for the next two years. When he has fired three years, call him in and give him a thorough examination. If he cannot pass, set him back six months; at the end of that time, if he does not know enough to take an engine on the main line, drop him off the list—make a hostler of him, or place him where he will be out of the road of any other promotion. The effect of this will be to keep the men who know they cannot make A1 engineers from entering the service, and encourage the bright ones to work for a good job, instead of waiting for some one to die or get discharged, and they get promoted because they are at the top of the list in age of service. Seniority should be first—all other things being equal—but if the oldest man on the list does not fill the bill let the next man on the list have a chance. There is no use waiting for a man to have an accident, to prove him incapable, before you set him back, that is not safe.

Right here, examinations alone do not make smart men or good runners, but they generally show up the poor, ignorant ones. It will show how much knowledge of their business they possess, and give a fair idea of their general ability. A knowledge of what to do in case of accident gives an engineer presence of mind that the inexperienced one does not have. Call his attention to all the difficulties he will have to encounter; when he does meet them, he will not get rattled so quick.

As to examination on time card and running regulations, no one will dispute the fact that it is absolutely necessary before a man goes out on the road either as an engineer or conductor. All should understand the rules alike, there is no other way to get their exact understanding of the rules except by an examination. With us this is done by the general superintendent, and any men hired that have seen service on any other road, no matter how capable they are, are examined on our rules before going out in charge of an engine or train.

Grand Rapids. C. B. CONGER.

Headlight Signals on the Southern Pacific.

Editor The Locomotive Engineer:

Seeing some discussion in your valuable paper in regard to darkening headlights at meeting points of trains, will say that it is practiced here (on the Southern Pacific, Atlantic system), and liked very much by the employes using it. But the system is not used as W. de Sanno says. I notice he says "The headlight and *all* train lights must be darkened on the trains in siding." In the Book of Train Rules S. P. Co. on page 10, Rule 34, Train Signals, reads: "Each train running after sunset, or when obscured by fog or other cause, must display the headlight in front, and two or more red lights in the rear." Now on p. 14, Rule 74 reads: "When a train turns out to meet or pass another train, the red lights must be removed and green displayed as soon as the track is clear. But the red must again be displayed before returning to main track."

"Headlights on engines—when on side tracks waiting for trains—must be covered as soon as the main track is clear and train has stopped."

Now Mr. de Sanno says: "In the writer's experience, when making a meet, to see the headlight of the other engine on the side track, and know they are in out of the way, is a great deal more satisfactory." Well, now here is right where the shoe pinches, as there are many side tracks on these western roads where one can see a headlight for miles, and you take a dark, rainy night, and poor steaming engine, with a bad working injector perhaps, so that much of the engineer's time is occupied in watching the steam gauge and water level, and trying to get his injector to work, and at the same time trying to get every turn out of his old mill he can, with a train of time freight, it is the easiest matter in the world for him to lose himself, or not be able to tell just where he is on these prairies; now let a headlight loom up in front of him, and if he can say within a mile or two of how close they are to him, or whether they are on the siding or not, he is a dandy, and can do far more than the average man can. The average man will, under such circumstances, shut off, and likely lose five or ten minutes coming up to where he is certain that the main track is clear.

Now we will take the same conditions here on the S. P. R. R., according to the extracts from book of rules previously given, and as practiced here; if the runner sees a headlight in front of him he knows right then that the main track is not clear, and is governed accordingly. On the other hand, if he sees a faint white light and a green light in the distance, he knows the main track is clear, and goes whirling by at full speed, not even slacking up. Now you ask, What is the faint white light just mentioned? Well, you see, all the engines here have their numbers painted on front glass of headlight, also the number of engine cut through headlight curtain, or cover, to tell the number of engine in the night time; and the light that shines through these numbers can be seen for a long ways, although of course not as far as a headlight could be, and is easily distinguished from the uncovered headlight. As to safety, I cannot see how there is the slightest chance of accident, except by the grossest negligence and disobedience of plain rules, as when we pull into the siding we must not cover our headlight until the green lights are displayed on caboose, which tells us we are in to clear.

Now after we are in siding, and green lights displayed and headlight covered, suppose another train comes up behind us, say a second section. We must immediately uncover our headlight and display red instead of green lights on caboose until both trains are in to clear main track. In case siding will not hold both trains, headlights are left uncovered and *red* caboose lights displayed.

When meeting a train which is on siding, the runner instinctively looks first to the caboose of the train he is meeting for the green lights, and then sees that the number of the engine, as shown by the light shining through the numbers cut in the headlight cover, is the one specified in his order, provided he has orders to meet them.

I have never heard of an accident happening from the system yet, and it has been in use here for years, and, as I before said, is well liked by all the employes. All the engines here are equipped with air-brakes, as are all the S. P. cars. I believe the track is the finest in the Southwest, and that they have the cleanest and best kept roundhouse and engines. W. C. PARSONS.

San Antonio, Tex.

The Traveling Engineer's Breakdown Puzzle.

Editor The Locomotive Engineer:

In reply to the Cunningham breakdown puzzle, I should say that the engine had a double nozzle, and blew the right-hand nozzle out.

Brooklyn, N. Y. T. R. S.

Editor The Locomotive Engineer:

I will try to give an answer to the breakdown puzzle that is published in the September LOCOMOTIVE ENGINEER. As Mr. Cunningham found eccentrics in place, and valve yoke and ports all right, and machinist reported cylinders and all O. K., would say one of his rocker arms or rocker shafts might have been bent or sprung, causing engine to be lame. B. R. WOODLIEF.

Brookfield, Mo.

Editor The Locomotive Engineer:

I would like to solve the puzzle in last number of THE LOCOMOTIVE ENGINEER, by placing the trouble to a nozzle that wanted cleaning out, or one of the bushing rings had blown out of nozzle, or the rods were not lined up right, or link block bolt might have worked loose on bottom of rocker arm. I have seen the latter affect an engine in the way spoken of in your paper, and this is my idea of the matter, and I would like very much to know more about it. J. D. MCKENZIE.

Palatka, Fla.

Editor The Locomotive Engineer:

In looking over THE LOCOMOTIVE ENGINEER there came to my notice a question by a Traveling Engineer concerning a lame engine on the Mobile & Ohio, which was in charge of Alex Cunningham.

In answer to the question would say that, as the engineer had looked his engine over very carefully, and could discover nothing loose, and the shop men had taken up the steam chest cover and found everything all right, that the only thing that comes to my mind, or rather the one which I think is right, is that the lower rocker arm was sprung out of true with center line of motion.

Detroit, Mich. BRANDON LEONAN.

Editor The Locomotive Engineer.

In answer to question signed Traveling Engineer, Philadelphia, Pa., I would think the trouble was with the forward bridge being broken or a piece being broken out of valve. H. R. YARD

Portsmouth, Va.

Editor The Locomotive Engineer:

That traveling engineer's question is worthy the attention of the best engineers, but I am going to try it, if I am a fireman.

There might be such a thing, although hardly possible, that a bridge would break and move in such a way as to close the port.

I think the real trouble was in the eccentric blade becoming loose on the strap and moving with each stroke of the engine so as to make her miss an exhaust. J. C. SICKELS.

Winchendon, Mass.

The Answer.

Editor The Locomotive Engineer:

I suppose the boys will all want to know what was the matter with Alex Cunningham's engine, but, for fear they won't all understand it, I will restate the case:

Alex. Cunningham was running an old eight-wheeler on the Mobile & Ohio a few years ago, and all at once she commenced to limp.

"Three legs," said Alex. to the fireman. "She's slipped an eccentric."

He stopped, got down, and examined her carefully, but her eccentrics were in place, and her valve motion all right.

"It must be a broken valve yoke," mused Alex., so he got up and tried her.

Steam came out of the right back cylinder cock only, and Alex. took up the right chest cover, only to find the valve, yoke and ports all right.

He got up to move her to hunt farther, and she seemed to go all right and he gradually increased speed and finally ran in.

The machinists took up both chests, looked into both cylinders, the front end and everything else, and swore she was all right, and Alex. made another trip with his three-legged pet.

He reported the right side examined again, and they found the trouble at once. What was it?

Almost everybody that I ever mentioned this case to said it was a nozzle that got plugged, but if that was true she would not have gone on three legs.

When the machinists took off her right cylinder head she stood on the forward center on that side, and the piston stood close up, apparently all right. But the second time they took off that head one man touched the piston with his hammer and found it loose. The piston rod had broken off close up to the head, and the Dunbar packing had dropped into the counterbore and port, and held the head there, shutting off steam from the forward end of the cylinder and disturbing nothing else.

Of course the piston rod played back and forth innocently, the exhaust from the back end of the cylinder was regular, but the forward end was laying off. It was a puzzle while it lasted.

TRAVELING ENGINEER

Philadelphia, Pa.

Those Worn Lubricator Glasses.

Editor The Locomotive Engineer:

I wish to answer E. G. R's. question, in the Sept LOCOMOTIVE ENGINEER, regarding the wearing of the top end of the Nathan lubricator glasses. I think I have the explanation, which will be made plain by referring to page 447 of Forney's Revised Catechism of the Locomotive, of 1890. At the top of the glasses there is, when the lubricator is in operation, a continuous circulation of water and steam, down from the top of the steam chamber or condenser, through two small pipes, one on each side, past the top end of the glasses, and out through the pipes, which lead to the cylinders. There is *no* circulation of water around the *bottom* end of the glasses, hence they are not worn at the bottom. The only opening at the bottom is the small nozzle through which the oil feeds. The wearing of the top of the glasses is not caused by any chemical action of any acid in the oil, but by the purely mechanical action of the water circulating past the top end of the glasses. There is not necessarily any circulation of water *in* the glasses sufficient to cause much wear. About the only acid that would injure the glasses is hydrofluoric, which would be very injurious to valves, valve seats, and cylinders. I have frequently noticed, in taking broken glasses out of the Nathan lubricator, which is used almost exclusively on the O & M R R, on which road I am employed as fireman, that the top end was worn almost entirely away. This I think is the only explanation.

SAM. M HUFFMAN

Seymour, Ind.

[Our correspondent does not seem to understand that the trouble with the glasses illustrated was wear *on the outside* of the glass, just where it is protected by a rubber gasket, and can, apparently, receive no wear.]

Something About Bulletin Boards.

Editor The Locomotive Engineer

With little hope of its reaching a point where it will do any good, I want to submit a few thoughts and suggestions that have claimed my attention while in the motive power service. The bulletin boards for the use of the motive power department with which I have been most familiar have been located in the roundhouse, where the orders soon become unintelligible from exposure to the variously charged atmosphere of the place. This plan has one advantage, however, for a new order always appears conspicuous, but the large "acreage" of space required for the display of a few hundred "full sheet" orders is so great that one board after another is put up in different parts of the building, and when all the available space is occupied, or all the lumber the company will furnish is used up, the leaflets begin to appear on the window casings and cupboard doors.

A man who takes it into his head to look over the bulletin board before departing on his run, and be ready to make affidavit that he has left no order on the board "unnoticed," has a very respectable excursion in quest of knowledge before him, and one which "thirty minutes before departing time" will hardly suffice for him to complete. Especially is this the case with a "new" man just entering the service, when the orders are tacked up two or three deep, with only a small margin of some of the first few layers visible.

Another crying evil of this bulletin board—lack of—"business" is that of allowing orders that are void, or have become inoperative from any cause, to remain on the board. This has an effect similar to that produced by leaving slow flags out for bad track for days after the track has been put in condition for the usual speed. It gives the impression that the whole thing is old and out of date, and the company does not attach much importance to it anyway.

Another thing that would relieve the bulletin board of much of its overload would be to transfer all orders that are of a permanent nature, and have been in effect long enough to show that they represent the fixed policy of the road, to the general rules on back of time card. By a judicious cleaning out of the old and obsolete, and condensing the old and permanent into print, and then providing a separate "clip" for each official who has authority to issue bulletin orders, and then placing the orders in the clips in the order in which they are issued, the task of checking over the bulletin board would be much simplified, and the company be much more sure of its being done.

Chillicothe, Mo. A. H TUCKER.

One of our 'steemed contemporaries mentions a starting valve designed and *patented*, and says, "the details have not been made public." How can a patent be issued without describing the invention to the public?

The Norwood Car Replacer Company, of Baltimore, are building an extensive shop at Lambert Point, near Norfolk, Va. This company are doing about all the replacer business done in the country—they are alive.

The Old Colony put an extra inside check behind the regular check valve; this, it is hoped, will close up if the outer or common check is broken off. They also use an automatic valve under the fountain, or combination stand, in the cab.

Some Russian Methods.

The Central Association of Railway Officials, which is composed of officers at Cincinnati, Indianapolis, Columbus and Louisville, has under consideration a plan for uniformity in the way of discipline, which was formulated by the committee on subjects. The majority report is as follows:

Leaving key open, 30 to 60 days or indefinite suspension.

Grounding line unnecessarily, 30 to 60 days or indefinite suspension.

Failure to deliver order, 30 to 60 days or indefinite suspension

Failure to complete order, 10 to 30 days or indefinite suspension.

Failure to deliver message, 10 to 30 days or indefinite suspension.

Failure to try air-brakes or whistle, 30 to 60 days or indefinite suspension.

Untidy uniforms, 10 to 30 days

Running through switch, pay, or two weeks to 30 days suspension.

Breaking draw-bar, pay, or 1 to 2 weeks suspension.

Burning off journal, 30 days or indefinite suspension.

Breaking machinery of engine, 2 weeks, 30 days or indefinite suspension.

Break in two and collision, 30 days, 60 days or indefinite suspension.

Killing stock, 10 to 30 days suspension.

Damage to public, and personal injury, 30 days or indefinite suspension.

Derailment through carelessness, 10 to 30 days suspension.

Yard collisions, 10 to 30 days suspension

Violation of flag rules, 30 to 60 days or indefinite suspension.

Violation of speed orders, 30 to 60 days or indefinite susnension.

Failure to register, 10 to 30 days suspension.

Failure to sign bulletin orders, 10 to 30 days suspension.

Failure to give or to answer signals, 10 to 30 days suspension.

Striking inspector's flag, 30 to 60 days or indefinite suspension

Running on incomplete orders, 30 to 60 days or indefinite suspension.

Running past block or other signals, 30 to 60 days or indefinite suspension.

Running by trains loading passengers on double track, 30 to 60 days or indefinite suspension.

Drinking on duty, indefinite suspension.

Intoxicated off duty, indefinite suspension.

Burning engine, indefinite suspension.

Refusal to take runs, indefinite suspension

Insubordination, 30 to 60 days or indefinite suspension.

Anger and fighting on duty, 30 to 60 days or indefinite suspension.

Hauling cars wrong, pay 2 cents a mile or 10 to 30 days suspension.

Rough handling of cars, pay damage or 10 to 30 days suspension.

Setting switch wrong or leaving switch unlocked, 30 to 60 days or indefinite suspension.

Failure of engineer, fireman or brakeman to keep lookout, pay damage or 10 to 30 days suspension.

Failure to examine switch after using, 10 to 30 days suspension.

Failure to set brakes or block wheels on siding, 30 to 60 days or indefinite suspension

Tying down block signal, 30 to 60 days or indefinite suspension.

Asleep on duty, 30 to 60 days or indefinite suspension.—*Indianapolis News.*

If the above iron-clad rule is put into force we can promise the roads in question one of the most decisive and destructive riots they ever read about. People who can calmly sit down and formulate a plan like this for keeping up rolling stock, paying wages and wear and tear for nothing, deserve something better than minor official positions—say perpetual exhibition in a cage provided by an admiring public, or crucifixion.

The Railway Age and the Northwestern Railroader is a pretty long name, but that is the way the consolidation of the two papers leaves it. Mr. Harry P. Robinson, founder of the *Northwestern Railroader*, will have control of the combined properties. Mr. H. R. Hobart, editor of the *Railway Age*, becomes vice-president of the new concern. Mr. Talbot, founder of the *Age*, retires. The new paper will be better than either of the old properties, and, with the enterprise and push found in young blood, ought to be found up close to the band wagon in the procession of general railroad and financial papers. Success to it.

The word knot, signifying a certain distance over water, is one-sixtieth of a mean degree of the earth's meridian, which in figures is 6,070.818 feet, 2,023.6 yards, or one mile and 2,650 yards.

LOCOMOTIVE ENGINEER.

THE OFFICIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN LOCOMOTIVE MAINTENANCE AND REPAIRS

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CONTENTS.

Some Points on Radial Stayed Boilers from the D. & R. G. Ry.

There is probably no other road in the country where they have had more experience with radial stayed boilers than has the Denver & Rio Grande. They have used this class of boiler for some fifteen years or more, have had all kinds, styles and sizes, and opinions on this subject from Mr. Sample, the Supt. of M. P., or Mr. Mitchell, the foreman boiler maker, are valuable.

All engines on this road are of the Baldwin build, and those built to the specifications of the road have extended wagon tops, and a nearly flat crown sheet.

This form of crown has been used in narrow gauge boilers for a good many years with the best of results.

One of the beneficial results claimed by some is the enlarged heating surface, caused by the possibility of getting in from four to six more flues than with the arched sheet, but this we think a doubtful advantage. This form of crown has little strength of itself, and depends for support entirely upon its stays, and its friends claim, and not without reason, that this is a safety element. The arched sheet has a great deal of strength from its form, and would doubtless withstand considerable pressure without crown stays at all. When this crown sheet gets bare and becomes overheated its form helps support it, and it will in consequence stand more pressure before collapse. When the water leaves it, the center rows of stays and surrounding sheet are heated first, and get hotter, and consequently weaker, than the others. When the pressure is great enough, the center starts first by tearing out the central stays, then there is only one row of stays to pull out at a time—a shearing action—and the collapse amounts to an explosion, often taking the crown, and occasionally the whole firebox out of the boiler.

The flat crown is heated more evenly, and will pull off the stays at a much less pressure, giving a large number of holes for the relief of the boiler—an enormous safety plug. The sheet seldom tears out the outside stays or injures the side or crown sheets, and can be put back to its original position with jacks.

A large number of these flat crown boilers have been scorched there in the past, but in no instance has the crown sheet gone to the grates, nor has a single individual been seriously injured by the collapse.

The Rio Grande have some arched crowns, but they have given the same trouble there that we hear of in other places—they crack near the front flue sheet, or the flue sheet is cracked there, while no trouble is experienced with the flat crowns.

Boiler maker Mitchell thinks the cracking in their case comes from the constant expansion or rolling of tubes to keep them tight; this enlarges the holes in the flue sheet, and raises it at the seam, relieving the forward stays of strain, and making the joint higher than the rest of the sheet. When the arched crown boiler is fired up, the expansion throws this strain to the center, and causes a crack, while the flat crown can "go somewhere" with its expansion.

A great deal of trouble has been avoided in a lot of new boilers built in the Denver shop, by putting in sixteen less flues, and keeping them down from the crown. In staying these crown sheets the stays are put through the crown straight, and allowed to strike the shell where they will—it's the crown that needs to be stayed, not the shell—on the side opposite the corner seam of the side sheet and crown; the stays in the shell are 16" apart, and no trouble is experienced with them—these crown sheets are only arched about three inches.

Considerable trouble was experienced here in cracking of the side seams between crown and side sheets, and it was believed to come from burning of the rivets and joint, or to undue expansions, caused by the fire striking these seams, and an experiment was tried in covering them with a cast-iron shield held on by studs; where this was done no trouble was had, and the shields have been put into a great many of the boilers; they burn out in four or five weeks.

Mackey beats the record from Frisco to New York.

Instruments of Torture.

Can't you do something to relegate to the scrap heap that damnable implement of torture, the common check valve? Hundreds of unfortunate human beings—most of them enginemen—have been cooked alive by them.

A check screwed directly into the boiler is the worst form, the one with flanges held by studs is better, in that it is stronger, but both are dangerous. The inside check is an improvement if of good design, but checks placed on the boiler head are better, cost less for pipes, make the engine look better, are less liable to freeze up, and are far safer. There is no trouble in using them, running an open pipe from the check, inside the boiler, to near the front.

If all the victims of this device could be exhibited at once to a select audience of railroad officials, who have the power to change this thing, there wouldn't be many running in a month, and the man that retained them would be mobbed.

Just as We Talk of Electricity or the Flying Machine.

When a railroad was proposed from Boston to Albany the Boston *Courier* of June, 1827, said: "Alcibiades, or some other great man of antiquity, it is said, cut off his dog's tail, that quidnuncs might not become extinct for want of excitement. Some such motive, we doubt not, moved one or two of our natural and experimental philosophers to get up a project of a railroad from Boston to Albany, a project which every one knows, who knows the simple rule of arithmetic, to be impracticable, but at an expense little less than the market value of the whole territory of Massachusetts, and which, if practicable, every person of common sense knows would be as useless as a railroad from Boston to the moon."

Engineer Mort. Winters, of the P., Ft. W. & C., was pulling an excursion train on the 13th of Sept., when a side rod let loose, broke a driver, knocked the cab into splinters, and made worse havoc when it began to cut off the boiler attachments, and let loose the steam and boiling water. The engineer got onto his feet all right, but couldn't get to the brake valve, so he climbed over the tender, and, crawling partly under the platform of the first car, uncoupled the hose, thus setting the automatic brake. The train came to a standstill, and no one was hurt. You may call this heroism or what you like, but it shows above everything else that this engineer was the right man in the right place, and made of the proper material for engineers of the best grade.

Beheaded in His Engine.

Richard Nash, of Philadelphia, engineer on the fast Reading express, while on the lookout, September 2d, was struck by an obstruction near Oreville Station, and his head was severed from the body. His body hung out of the cab window some minutes before the fireman discovered what had occurred.—*Daily Paper*.

This is the second engineer killed on the Reading in the same way within a year. How would it do to remove some of those obstructions, fasten some of the water cranes, and destroy some of the things they call mail catchers?

Scrambled Geography.

It is interesting to note that the largest locomotive yet built in England weighs 84 tons, and is 46 feet over all. On a gradient of 1 in 40 the engine can, by exercising its full capacity, move 200 tons. It is a product of the Hirschen works in Munich.—*Railway World.*

A dust guard for cab windows has been patented by Frank C. Bond, of Port Jervis, N. Y. It consists of a narrow pane of glass hinged to the window frame in front of the loose, or sliding pane. It is held out at right angles to the side of cab, and acts as a dust or cinder guard, the runner being able to see through it while looking ahead.

ASKED & ANSWERED.

(60) I. C. B., Washington, Pa., asks:

How could I become proficient in the art of sketching, making free-hand drawings of machinery or other objects? Is there any book that treats exclusively of this art? *A.*—There is no work of this kind that we know of. If you have a talent for that kind of work you should secure a teacher; practice is the great essential.

(61) T. R. S., Brooklyn, N. Y., asks:

1. Does a direct-motion engine increase her lead when hooked up the same as an indirect? *A.*—Yes. 2. Has the old original patent on the Richardson balance slide valve run out, or has it been renewed? *A.*—The original patent has expired, but there are a number of patents still in force on details and parts, the device is still pretty well protected.

(62) R. H. Man, Ludlow, Ky., asks:

Do you know of roads in other sections of the country where an all round machinist, used to running repairs, can get a show to become a locomotive engineer? A farm hand gets a better show here than a mechanic. *A.*—Perhaps you are too old to go firing, as that is the only way to learn locomotive engine running. We know of no road where machinists are encouraged to go on the road. The best way is to have a square, honest talk with your superior officer on this subject, tell him what you want and why you want it. If you are thirty five don't try it unless you want to wear yourself out about four years ahead of time.

Book Reviews.

HOW TO MAKE MONEY OUT OF INVENTIONS. AN ADVISER FOR PATENTEES. By August Schemmel. Published by C. A. Rohde Co., Milwaukee, Wis. Paper cover. Price 50 cents.

This little book is a collection of facts about inventions, patents and inventors. It tells pretty nearly everything an inventor wants to know about getting patents in this and foreign countries. It is not published in the interest of a patent lawyer, and is in no sense an advertising scheme. Part second contains a long list of firms who build machinery and patented devices, dealers who sell, and newspapers who advertise articles that inventors want, or should have. To any young man, or old one either, who has an inventive bug in his ear, this little work will be worth many times its cost.

THE NATIONAL CAR AND LOCOMOTIVE BUILDER "SUPPLEMENT." Yearly. John N. Reynolds, 110 Nassau street, New York. Free.

This publication is a monument to the skill of its publisher, John N. Reynolds, as an advertising solicitor, for it does not contain a line of reading matter. There is, beside advertisements, the list of railroads officials, etc., published monthly in the parent paper, and an index to the advertising. It is really an indexed collection of trade catalogues, and as such is useful.

POOR'S DIRECTORY OF RAILWAY OFFICIALS AND MANUAL OF AMERICAN STREET RAILWAYS. H. V. & H. W. Poor, 70 Wall street, New York. Price, $2.00.

This is a complete directory of the railroad officials of North America, with their titles, address, etc. The street and private railroad directory covers the entire western hemisphere. The entire work is very carefully indexed, and no official, town or shop, is hard to find. There is also a statement relative to the lines of railroad now projected in this country. The book is well bound in boards, and is the best and most accurate list of officials we know of. There is so much change in this field that any list is good but for a short time.

A Good Pumper.

The pretty little romance about "A Woman at the Throttle," on the Cairo & Kanawha Valley Railroad, in West Virginia, proves to have a slight basis of fact. Miss Ida Hewett, the daughter, not of a "heavy stockholder" but of a farmer, tends the engine at a pumping station. It is no doubt true that, as the story states, she has no mean ability as a machinist, but on the other hand it is only fair to say that the engine of a pump house is seldom mean enough to make very pressing demands upon the mechanical skill of its custodian. Miss Ida "makes her daily run with as much regularity as the most veteran engineer," but the run is only from her dwelling to the pump house.—*Railway Gazette.*

The grocer who is old fogy, don't keep the best stuff and follow business methods—who is not up to the times—fails, and has to get out. The railroader who falls behind modern practice, who is old fogy, and who studies prize fighting or agriculture more than his business, is held up by the company and his companions, if he stood on his merits he would be set aside, like the grocer. Study your business.

The Evolution of the Modern Brake Shoe.

SOME HISTORY OF AN AMERICAN INVENTION.

In our issue of February we asked who invented the common cast iron brake shoe now almost universally used on all rolling stock.

Mr. Wilson Eddy, for many years at the head of the motive power department of the Boston & Albany road, and whose railroad experience dates back to 1840 and a little beyond, at once answered that the cast-iron shoe was invented and patented by Stephen Morse, Feb. 23, 1858.

The Westinghouse Air-brake Company took considerable interest in the matter, and sent out some inquiries on this and other brake subjects, receiving many interesting replies. Their letter, sent to the men who were railroading in the long ago, contained the following questions:

First. If wood brake shoes were ever used, to your knowledge, state where and when.

Second. Was their use general or special?

Third. What kind of wood was used?

Fourth. On what class of equipment?

Fifth. When was their use discontinued, and why?

Sixth. Have you any knowledge of the use of any other kind of brake shoes than wood, cast-iron, steel, or such as are in common use at this date? If so, of what was their composition?

Seventh. Have you knowledge of the use at any time of what is known as the sledge brake in steam railway practice; that is, a shoe capable of being forced against the rail, and what was the material of which such shoes was composed?

Eighth. Give as complete historical facts as possible regarding the use of brake shoes of any kind other than those in common use at the present day, and suggest the names of other persons most likely to be acquainted with the desired information.

The answers having been submitted to us, we take great pleasure in collating the following from them.

REUBEN WELLS,

Supt. of the Rogers Locomotive Works, Paterson, N. J., gives some interesting historical data as follows:

"In reply to your first question: Yes; wood brake shoes were exclusively used on the cars and tenders of the equipment of two or three coal roads in the State of Indiana, of which I had charge of the machinery, in the years 1852 and '53, and had been used there for four or five years previous. These roads were about 25 miles from Indianapolis, and were then known as follows: Rushville & Shelbyville R. R., 20 miles long; Shelbyville & Edinburgh R. R., 16 miles long; and the Knightstown & Shelbyville R. R., 27 miles long.

"These roads were laid with 'strap' rails—iron 2½" wide by 1" thick, laid on and spiked to longitudinal timbers, which were in their turn laid on cross-ties notched out to retain them.

"Our cars were light, but were of the same weight and pattern as the Madison & Indianapolis, and other western roads. The M. & I. was at that time laid partly with strap rails, and partly with light T rails. The cars of this road ran over the small roads with which I was connected, and I remember that they all had wooden shoes, passenger cars and all.

"In 1854 these little roads were consolidated with the Jeffersonville & Indianapolis R. R., and I went to Jeffersonville in charge of the machinery, where I found wooden shoes on everything. The wood used was generally white oak, but sometimes beech and hickory.

"The usual shape of these shoes was about as in Fig. 1 (next page), the dotted lines representing the wheel, *A* the brake shoe and head, in one piece, with the grain of the wood vertical, *B* brake beam held by a bolt and tenant, *C* brake hanger, *D* a bolt through the shoe to prevent splitting, *E* pin through hanger and shoe, *H H H* wooden pins about ⅝ or ¾ inch diameter were generally put in, their ends flush with the face of shoe, to insure durability.

"This was the general form of the shoe; in some cases for freight cars the shoes were hung to the truck and between the wheels, while others hung from the body of the car. This, I think, answers your 2d, 3d and 4th questions.

"It was probably 1855 when the use of wooden shoes began to be discontinued. At first the increased braking power required, as the cars and loads became heavier, caused rapid wear, making their maintenance troublesome and expensive. To avoid renewing the whole shoe when worn down, wooden pieces were cut out by machinery and spiked onto the old blocks, as shown at *A*, Fig. 2. These very soon wore out or got loose and came off, and were abandoned, and wrought iron pieces of that shape were bolted on by two countersunk head bolts, as shown at *B B*, Fig. 2.

"On the road mentioned, these wrought-iron pieces were made mostly from old 'strap' rail, as it was taken up and replaced with T rail. In going down long grades this shoe would get hot enough to burn or char the wood to which it was bolted, and it then became loose and gave trouble. Then a cast-iron shoe was used, having air spaces between it and the wooden brake head, as at *D D*, Fig. 3; these shoes were held by two bolts *B B*.

"The use of this cast-iron shoe began about 1855 or '56, but in a year or so the cast-iron brake head and its detachable head began to be used, and gradually took the place of everything else, but I cannot fix the exact date. I have no knowledge of steel brake shoes being used at that early date.

"The only case of a 'sledge' brake being used, to my personal knowledge, was in the case of a ten-wheeled coupled engine, which I built in either 1867 or '68 for working on the one and a half miles of 320 foot grade on the M. & I. road, as it was then called, at Madison, Ind.

"The 'soles' or 'shoes' of these sledges were made of wrought-iron, and were fastened to wrought-iron backs or tops; they were forced down by two steam cylinders, *C*, Fig. 4, the pistons of said cylinders being so connected by levers that about one-third of the whole weight of the engine, 112,000 pounds, could be thrown upon them. These sledges were located as at *A*, Fig. 4, the engines always worked with the front end up the grade, and these brakes were for use only when the cylinder power or other brakes failed to hold, but when used they answered the purpose very well, and were used until very lately, the engine being still at work there.

"The braking force used in letting trains and engines down this grade was the cylinders of the engine. A valve and attachments were in use that connected the two steam passages to the two ends of the cylinders, so that the valve between them could be opened wholly or in part by a lever in the cab. In descending, the valve motion was reversed, and the valve between the two ends of the cylinders opened, so as to allow the air on the compression side of the piston to flow to the opposite side through this connection, the valve acting as a regulator of the resistance. This arrangement answered the purpose so well that no other brake force was required, and the 'sledges' were seldom used."

WILLIAM SWANSON,

General Master Mechanic of the Pittsburgh, Cincinnati, Chicago & St. Louis Ry., spent long years on the Little Miami and Pan Handle. He says:

"Speaking of the brakes in use in 'ye olden time,' I recollect that on the Little Miami, in the early '50s, that is, about '53 or '54, we used a wooden brake head without a shoe, both for cars and engine tenders, they were made of oak, and hung from the body of the car. On passenger cars a piece of wrought-iron about 8 x1", made in the form of a gib, was bolted on the wooden head, these gibs were made of old arch bars or such scrap material as came to hand. The increasing number used, and the expense of new bar iron, was, I think, what led to the use of the cast iron shoe, which was also used on a wooden head. This kind of shoe and head was continued in use, as near as I can recollect, until near the close of the '60s, when cast iron brake heads began to come into use, and the process of evolution has continued ever since.

"We had a sledge brake on one of our Madison inclined engines, the shoes were about 24" long, and were forced upon the rail by two direct steam cylinders, it was applied by Mr. Reuben Wells in 1868, and used up to 1885, when air-driver-brakes were applied."

ALBERT GRIGGS,

for many years in charge of the motive power of New England roads, writes:

"Wooden brake shoes were in use on the Boston & Providence road long before 1848, and for years after that. They were of oak, and were in general use on freight and passenger cars, as well as for driver brakes and on tenders. Their use was discontinued about 1856, on account of their burning out on grades.

"Leather was used on the Boston & Maine on passenger equipment in 1845, and a long time after; some leather was used before that time on the Boston & Providence; the leather was fastened to wooden shoe with nails.

"A sledge brake was also used on the Boston & Providence on one or two cars as an experiment; this was in 1847.

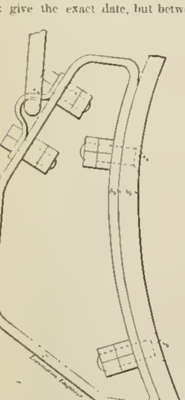
"Stone shoes were used about the year 1853, but with what success I never knew.

"I wish to mention that about the year 1847, my father Geo. S. Griggs, had passenger trains on the Boston & Providence road equipped with automatic brakes on all cars, and the tender and steam driver brakes, all of which were his inventions. He patented the automatic brake."

ANDREW J. CROMWELL

has been with the B. & O. all his life, and says:

"Wooden shoes were used on the B. & O. from its opening until some time in the early 50s, cannot give the exact date, but between '50 and '53, perhaps. Wood was in general use except on iron coal cars, ash and oak being generally used; their use were discontinued on account of their taking fire and burning out on our mountain grades.



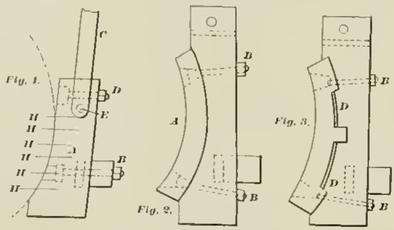


Fig. 1. Fig. 2. Fig. 3.

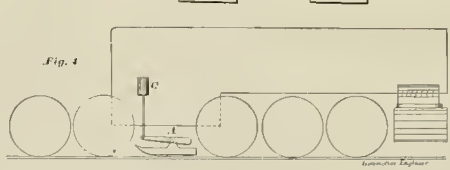


Fig. 4

"Wrought-iron shoes riveted to cast-iron blocks superseded the wooden shoe. We never used sledge brakes.

"Wrought-iron shoes were used on the B. & O. passenger equipment until 1882, when the Christie cast-iron shoe was adopted. Cast-iron shoes were applied to our freight cars in 1872 and '73."

G. B. HAZLEHURST,

the General Supt. of M. P. of the B. & O., refers to Mr. Cromwell's letter for the facts, and sends the sketch shown at left of page, which shows the form of wrought-iron shoe and head used on his road for passenger service up to 1882.

F. D. ADAMS,

General Master Car Builder of the Boston & Albany, has had no small amount of experience; he says:

"My experience is not so great as some others, but dates back into the '40s. When I first went at the business, wooden brake shoes were used exclusively, the head and shoe were in one piece, and when this was worn down it was often shod with another piece of hard oak, nailed on. We had no steel or wire nails then, and the cut nails broke off easily, and after a few renewals the head would be so full of broken nails that no more could be got in, then it had to be taken down and a new one made.

"I have seen leather used, but it cost too much, and it was hard to get a supply.

"I do not know of cars built prior to 1865, with other than wooden brake shoes.

"When I came to this road in 1870, nearly all the cars had wooden shoes, but we began to use iron shoes about that time.

"It was considered doubtful if iron would do as effectual braking as wood, but after their introduction this notion was dispelled."

JOHN KIRBY,

General Master Car Builder of the Lake Shore & Michigan Southern Railway, is president of the Master Car Builders Association, and has had over 40 years of experience.

"My first railroad experience was in 1848, and wood was then used for 'brake block'; no 'shoes' were used. In 1854 I went to Adrian, Mich., as foreman for the Michigan Southern, and there found them putting shoes onto the worn blocks, they were nailed on, toe nailed we called it.

"In 1856 cast-iron shoes were fastened to the wooden heads, and while these would not get on fire as easily as the wood, they would get hot enough to set fire at times; it was not a very uncommon thing to have a train come in with several brake heads burned off entirely; cast-iron heads were introduced in 1860.

"A good many years ago I saw a passenger car with a heavy shoe between each pair of wheels; it was turned up at each end, and when applied bore on the rail; I believe they were of cast-iron, but am not positive.

"In 1857 I equipped one coach with the shoes hung on top of the wheel; they were cast-iron shoes; it required too nice adjustment, and did not run long."

WM. BUCHANAN,

Supt. of Motive Power, New York Central & Hudson River R. R., has been with the Hudson River road about half a century, most of that time as master mechanic; he says:

"Wooden shoes were used on the branches of the N. Y. Central from 1847 to 1860, were made of oak and used on all kinds of equipment. We commenced to discontinue the use of wood in 1860, and since that time have used iron. I have never seen a sledge brake in actual use."

ROBT. McKENNA,

Master Car Builder of the Delaware, Lackawanna & Western, writes:

"Wooden shoes were used on the Hudson River road from 1858 to 1870; they were made of soft oak, and were on both freight and passenger, and were still in use when I left the Hudson River road, in 1870."

L. B. PAXTON,

Supt. of Rolling Stock of the Philadelphia & Reading, says:

"Wood brake shoes were used on this road when I entered the service, in 1847; they were in pretty general use on passenger, coal and freight cars.

"I think the discontinuance of wooden shoes commenced pretty soon after James Mullholland took charge of the motive power, in 1848; I suppose the object in changing to cast-iron was economy. I have no knowledge of any other form or material for brake shoes than that now commonly used."

E. FERGUSON

is now the head of a private enterprise, but was one of the Michigan Central's early officers; his recollections are interesting.

"When I commenced work on the Michigan Central, in 1844, there were no brakes used on cars or engines except on tenders, and this consisted of a large wooden block between the tender wheels, concaved and made to fit outside the wheel flange; they were worked by means of a long lever on the fireman's side of the tank, when not in use the end was hung on a hook; to operate it the fireman threw it off the hook, and put his foot or feet on it, and pressed down.

"In 1847-8 they put wood brake blocks on passenger equipment, and operated them by a chain and wheel, and, as they wore down, faced them with wood, using oak, elm or maple. These wore rapidly and burned off, and in 1850 they commenced to face them with wrought-iron, cast-iron, chilled-iron, steel and other patented devices until separate heads and shoes came into use."

JOHN HEADDEN

was one of the early master mechanics of the New Jersey roads, and was one of the experts in locomotive building who built the good, old, light weights, from the time of the war up into the '70s. He was Superintendent of the New Jersey Locomotive Works in Jersey City, and there is many a 16-inch "Headden" engine doing light service to-day; he says:

"Wooden shoes were used exclusively on the New Jersey R. R. up to 1850. The solid cast-iron shoe was then introduced, and preferred.

"There were several experiments with sledge brakes, cast-iron chilled blocks, made under my inspection—all failures.

"The common practice with me at first was to line the wood shoes with old leather fire hose, then I used spring steel fastened with wood screws well countersunk, then wood nailed on; this was the practice up to the introduction of iron brake heads, and these were soon followed by loose rubbers or shoes, bolted or keyed to the heads, as now commonly practiced."

DAVID CLARK,

one of the old stand-bys of the Lehigh Valley, now and for many years past Master Mechanic of the Lehigh Valley at Hazelton, Pa., related some of his experience to another officer of the road, who in turn states:

"Wooden shoes were used on the Beaver Meadow & Hazelton road from its beginning up to about 1854, when iron was substituted, as being more economical.

"Some years ago this road equipped two coal cars with a sledge brake invented by W. H. Hoffecker, the shoes were forced against the rails by screws, it was used on 4-wheeled cars only, and was not a success."

OSGOOD BRADLEY

is the senior member of the firm of Osgood Bradley & Sons, car builders, Worcester, Mass., and was early in New England railway service; he says:

"All roads in this part of the country used wooden brake shoes up to 1845; then they were faced with wrought-iron. We used two or three thicknesses of sole leather on passenger cars, to make them hold."

CLEMENT E. STRETTON,

the well-known railway expert of England, consulting engineer for the Association of Drivers and Stokers, and the author of historical and other works on railways, contributes the following interesting facts, showing that wooden brake shoes are still used in England, and placing the credit of the introduction of cast iron shoes there to an American, Mr. Geo. Westinghouse; his letter is interesting.

"From the earliest introduction of railways in Great Britain to the year 1871, the brake blocks or shoes were made of wood, willow and poplar being both considered very good for the purpose. In 1865 it became the practice to bore large holes in the wooden blocks, and to fill them with rosin and sand; this was done to increase the friction, as the introduction of steel tires in place of iron had reduced the hold of the band brakes. Numbers of more or less continuous brakes were introduced, and Fay's, Newall's and Clark's were tried, but they all had wooden blocks.

"Towards the close of the year 1869, information reached England that the Westinghouse air (direct) brake had been invented, and that at a trial, on the 18th of September, 1869, upon the Horseshoe Curve, Pennsylvania R. R., the brake blocks were of cast-iron. I was well acquainted with the forms of brakes in use in this country, and am convinced that only wooden blocks were in use in Great Britain in 1869, and also that the above mentioned trial upon the Horseshoe Curve was the first occasion upon which I ever heard of cast-iron brake blocks. Reference to reports and notes also shows that 'wood' was the only material then used.

"In 1871 the Caledonian Railway ordered some Westinghouse brake fittings for a trial train (and, as you well know, Mr. Geo. Westinghouse came over here). The brake fittings sent included cast-iron blocks for engine, tender and vehicles. Prejudice against engine 'driver brakes' was so strong that the Caledonian Co. declined to allow Mr. Westinghouse to fit any brake to the engine wheels, and would not allow him to replace the wooden tender blocks by iron. Mr W. therefore had to attach his brake cylinder to the tender hand brake and wooden blocks.

"An old Westinghouse reference book, published in Pittsburgh about 1874, Sheet 1, shows the engine and tender No. 92, just as it was when fitted at Glasgow in 1871, where I saw it. Mr. Westinghouse induced the Caledonian Co. to let him fit iron blocks to the carriages, and the first trial train was completed on the 23d of October, 1871. Those I believe to be the first cast-iron blocks ever used on a train in Great Britain.

"On March 23d, 1872, a second trial train with Westinghouse brakes was put into traffic, but still Mr. W. was not allowed to place brakes on the engine wheels, nor to put cast-iron blocks on the tenders.

"The London & Northwestern Ry. fitted a train of Westinghouse brake, and it was put into traffic between Euston (London) and St Albans, 13th of May, 1872. That company would not allow Mr. W. to fit his brake to the engine wheels, nor would it let him fit cast-iron blocks to the carriages; he therefore had to attach his gear to the existing wooden brake blocks, as used with the old chain blocks.

"The Metropolitan District Company fitted a Westinghouse trial train, and it ran its first trip 12th of Feb., 1873. That company allowed Mr. W to apply cast-iron blocks to its engine wheels and to all coaches.

"The London, Chatham & Dover, in Feb., 1873, fitted up the first 'boat train' with the air-brake. That company was not in favor of the cast iron blocks. It, however, allowed Mr W. to fit them to the carriages, but declined to let him put any brake upon engine wheels.

"At that period there was a strong prejudice against cast-iron brake blocks; some persons believed they would damage the wheel tires, others urged that wood held better, and could more effectually skid wheels; at that time, it must be remembered that the general impression in England was that a brake was of no use unless it skidded the wheels.

"It will be seen from these facts that Mr. W had some very uphill work to get engineers to adopt cast-iron brake blocks, but his few trial trains in time convinced many that cast-iron was far better than wood, both as regards holding power and expense.

"In June, 1875, the great Newark brake trials took place, and turning to my note-book, I find a record showing that the

Chain brake had 120 cast-iron blocks.

Smith's vacuum train had 74 cast-iron, 12 wood.

Westinghouse automatic train had 64 cast-iron.

Clark's hydraulic train had 64 cast-iron, 8 wood.

Barker's hydraulic train had 104 cast-iron, 8 wood.

Fay's train had 60 wood blocks.

Steele McInnes' train had 32 iron, 32 wood.

Westinghouse vacuum train had 60 iron.

"Kitson & Co. sent an engine and tender to that trial with a steam brake, but in order 'to prevent its doing injury to the tires,' they arranged jets of water to play upon the cast-iron blocks. It will thus be seen that in 1875, both cast-iron and wood were in general use, and as a fact much difference of opinion existed. That was not cleared away until 1878 to 1879, when Mr. W. Cap't. Galton and their experimental van upon the Brighton Ry completely settled the matter, and since that time cast-iron blocks have been generally adopted.

"I am of opinion that cast-iron shoes were first used in America, and were brought to England by Mr. Geo. Westinghouse, in 1871.

"At the time of Mr W.'s first visit to England, 1871, the only blocks that were in use on British railways were of wood. At the present time, all continuous brakes are provided with cast-iron blocks. There, however, still exists a large number of tenders and guards vans for goods traffic, which still have hand-brakes and wooden blocks, but these are being gradually replaced by cast-iron. Wrought-iron blocks Mr. Westinghouse found damaged the tires very much on the Brighton line, 1878. Leather shoes have not been tried for trains in this country. The question under notice is one relating to brake shoes which press upon the wheel tires, and does not in any way refer to 'sledge brakes.' In 1842, 1844, 1846, 1851, 1852 and 1858, various forms of sledge brakes were tried which had no shoes on the wheels, but simply sledges to press upon the rail; these sledges were tried made of steel, wrought-iron, cast-iron, wood, and wood and iron in small squares, the power being applied by hand-screw or by steam. All these sledge brakes proved failures, and lasted only for a few months each."

An Exciting Experience.

On September 2d a train on the Louisville, Evansville & St. Louis road was wrecked, and a dispatch from Hawesville, Ky., dated September 3d, tells the following story:

"Engineer App, of the train wrecked at Tell City, has arrived here to seek refuge from a mob, composed of the relatives of the passengers killed and injured in the wreck. The engineer was himself badly hurt, and had been taken to Troy on the relief train. When his wounds were dressed he was able to return home to Evansville.

"He boarded the train, and when it reached Tell City an angry mob began to assemble, declaring they would lynch App to prevent his escape. The track was obstructed, and the frenzied crowd gathered around the coach which contained the crippled engineer. The trainmen succeeded in placing App in a carriage, which was driven rapidly out of the little town, followed by a volley of stones and curses. The fugitive was driven to the river and ferried across to Kentucky.

"The people at Tell City attribute the wreck partly to the bad equipment of the road, and partly to the reckless speed at which the engineer took the train around the sharp curves. The whole community is excited, and threatens to tear up the tracks and demolish the road-bed."

It is altogether likely that Engineer App had to make time or give up his job; cases like his are not uncommon. If he is one of those fellows you see occasionally who run like the very devil over the worst track they can find, just to make some one "squeal," we are kind of sorry the crowd didn't get him. A locomotive is nothing to fool with—they are always loaded.

There are some good cars being built in this country with "squeeze" or "clasp" brakes—a shoe each side of each wheel. This form seems to be adopted for fear the one shoe form will do damage, but it don't seem to do anything of the sort, and few persons will claim that one shoe does not give braking force enough. The two shoe form calls for the provision and maintenance of almost double the amount of brake rigging, where simplicity is greatly desirable, and does not seem to offer anything in return but the doubtful satisfaction of having the "latest" thing out. Isn't it expensive style?

A Peg-legged Romance.

By John Alexander.

Some men are born heroes, some become heroic, and others have heroism thrust upon them—but nothing of the kind ever happened to me.

I don't know how it is, but some way or other I remember all the railroad incidents I see or hear, and get to the bottom of most of the stories of the road. I must study them over more than other men, or else the other fellows enjoy the comedies and deplore the tragedies, and say nothing. Sometimes I am mean enough to think that the romance, the dramas and the tragedies of the road don't impress them as being as interesting as those of the plains, the Indians or the seas—people are so apt to see only the every-day side of life anyway, and draw all their romance and heroics from books.

I helped make a hero once—no, I didn't either. I helped find the golden setting after the rough diamond had shown its value.

Miles Diston pulled freight on our road a few years ago; he was of medium stature, dark complected, but no beauty. He was a manly looking fellow, well educated enough, sober, and a steady-going, reliable engineer—you would never pick him out for a hero.

Miles was young yet, not thirty, but somehow or other he had escaped matrimony; I guess he had never had time. He stayed on the farm at home until he was of age and then went firing, so that when I first knew him he had barely got to his goal—the throttle.

A good many men when they get here take great interest in their work for a few months, until experience gives them confidence, then they take it easier, look around, and take some interest in other things. Most of 'em never hope to get above running, and so set down more or less contented, get married, buy real estate, gamble or get fat, each according to the dictates of his own conscience, or to the inclinations of his make-up—Miles figured a little on matrimony.

I can't explain it, but when a railroad man is in trouble he comes to me for advice, just as he would go to the company doctor for kidney complaint. I am a specialist in heart trouble—Miles came to me.

Miles was like the rest of 'em—they don't come right down and say, "Something's the matter with me, what would you do for it?" No, sir, they hem, and haw, and laugh off the symptoms, until you come right out and tell them just how they feel and explain the cause, then they will do anything you say.

Miles hemmed and hawed a little, but soon came out and showed his symptoms—he asked me if I had ever noticed the Frenchman's girl.

The Frenchman, be it known, was our boss bridge carpenter, and lived at a small place half way over my division—I was pulling express—but the freights stopped there, changing engines.

I knew Venot, the bridge carpenter, very well, met him in lodge occasionally, and once in a while he rode on the engine with me to inspect bridges. Venot's wife was a Canadian woman, and good looking for her forty years and ten children.

The daughter that was killing Miles Diston was the eldest, had just graduated from some Sisters' school, and was home. She was a very handsome girl, but you could fairly read the romantic nature of her being through her big, round, gray eyes.

Marie Venot was vivacious, and loved to go, but she was a dutiful daughter, and at once took hold to help her mother, in a way that made her all the more adorable in the eyes of practical men like Miles.

Miles made the most of his opportunities, but, bless you, there were other eyes for good-looking girls besides those in poor Miles Diston's head, and he was far from having the field to himself, this he wanted bad, and had come to get advice from me.

I advised strongly against wasting energy to clear the field, but to put it all into making the best show and in getting ahead of his competitors.

Under my advice, Miles disposed of some vacant lots, and bought a neat little house, put it in thorough order, and made the best of his opportunities with Marie.

Marie came to our house regularly, and I had considerable chance to study her; she was a sensible little creature, and to my mind just the girl for Miles, as Miles was just the man for her; but she confided to my wife the fact that she could never, never consent to marry, and settle down in the regulation, humdrum way—she wanted to marry a hero, some one she could look up to, a king among men, a marked man.

Mrs. A. told her that kings and heroes were scarce just then, but a whole lot of pretty good women managed to be comparatively happy with common railroad men—but Marie wanted a hero, and would take no substitute.

It was on one of these visits to Mrs. A. that Miles took her out for a ride, and accidentally, of course, dropped around by his house, induced her to look at it, and told her his story, asking her to make the home complete—it would have caught most any girl.

When Miles delivered her at our door, and drove off, I knew that there would be a "For Rent" card on that house of his in a few days, and that Marie Venot was bound to have a hero or nothing.

Miles took his repulse calmly, but it hurt; he told me that Marie was hunting for a different kind of a man than he was, said he thought perhaps if he would enlist, and go out to fight Sitting Bull, and could come home in a new, brass-bound uniform, with a poisoned arrow sticking out of his breast, she would fall at his feet and worship him. She told him she liked him better than any of the town boys, his calling was noble enough, and hard enough, but she failed to see her ideal hero with blue overclothes on, and cinders in his ears.

If any of Miles' competitors had rescued a drowning child, or killed a bear with a pen-knife about this time, I'm afraid Marie would have taken him—but as I said before, it was a dull season for heroes.

About this time our road invested in some mogul passenger engines, and I drew one. I didn't like the boiler sticking back between me and Dennis Rafferty. I didn't like six wheels connected. I didn't like a knuckle joint in the side rod. I didn't like eighteen-inch cylinders. I was opposed to solid-ended rods; and I am afraid I belonged to a class of ignorant, short sighted, bull headed engineers who didn't believe a railroad had a right to buy anything but 15x22 eight wheelers—the smaller they were the more men they would want. I got over that a long time ago, but I was cranky at the time I write of. The moguls were high, and short, and jerky, and they tossed a man around like a rat in a corn-popper.

One day as I was chasing time over our worst division, holding on to the arm rest, and watching to see if the main frame touched the driving boxes as she rolled, Dennis Rafferty punched me in the small of the back, and said:

"John, for the love ave the Vargin, lave up on her a minit. Oi does be chasing that dure fer the lasth twinty minits, and dang the wan'st has Oi hit it fare—she's a divil on the dodge."

Dennis had a pile of coal just inside and just outside of the door, the forward grates were bare, the steam was down, and I went in seven minutes late, too mad to eat—and that's pretty mad for me. I laid off, and Miles Diston took the high-roller out next trip.

Miles didn't rant, and write letters or poetry, or marry some one else to spite himself, or take the first steamer for Burra-burra-ga or Equatorial Africa, as rejected lovers do in stories. It hurt, and he didn't enjoy it, but he bore up all right, and went about his business just as hundreds of other sensible men do every day. He gave up entirely, however, rented his house, and said he couldn't fill the bill—there wa'n't a hero in his family, as far back as he could remember.

Miles had been making time with the Black Maria for about a week, when the big accident happened in our town. The boilers in a cotton-mill blew up, and killed a score of girls, and injured hundreds more. Miles was at the other end of the division, and they hurried him out to take a car load of doctors down.

They were given the right of the road, and Miles tested the speed of that mogul—proving that a pony truck would stay on the track at fifty miles an hour—which a lot of us cranks had disputed.

A few miles out there is a coaling station, and at that time they were building the chutes; one of the iron drop aprons fell just before Miles and the mogul got to it; it smashed the head-light, dented the stack, ripped up the casing of the sand-box and dome, cut a slit in the jacket the length of the boiler, tore off the cab, struck the end of the car, and then tore itself loose, and fell to the ground.

The throttle had been knocked wide open, and the mogul was flying. Miles was thrown down, his head cut open by a splinter, and his foot pretty badly hurt. He picked himself up instantly, and took a look back as he closed the throttle; everything was "coming" all right, he remembered the emergency of the case, and opened the throttle again; a hasty inspection showed the engine in condition to run—she only looked crippled. Miles had to stand up; his foot felt numb and weak, so he rested his weight on the other foot. He was afraid he would fall off if he became weak, so he had Dennis take off the bell cord, and tied it around his waist, throwing a loop over the reverse lever, as a safety element.

The right side of the cab and all of the roof were gone, so that Miles was in plain sight; the cut in his scalp bled profusely, and, in trying to wipe the blood from his eyes, he merely spread it all over himself, so that he looked as if he had been half murdered.

It was this apparition of wreck, ruin and concentrated energy that Marie Venot saw flash past her father's door on its way to the relief of the victims of a worse disaster, forty miles away.

Her father came home to dinner in a few minutes from his little office in the depot. To his daughter's eager inquiries, he said there was some big accident "in town," and that the "extra" was doctors from up the road. But what was the matter with the engine, the old gentleman didn't know; it was the 170, so it was old man Alexander, he said—and that's the nearest I ever came to being a hero.

Marie knew who was running the 170 pretty well, so after dinner she went to the telegraph office for information, and there learned that the special had struck the new chute at Coalton, and the engineer was hurt. It was time she ran down to see Mrs. Alexander, she said, and that afternoon's regular delivered her in town.

Like all other railroaders not better employed, I dropped round to the depot at train time to talk with the boys, and keep track of things in general; the regular was late, but Miles was coming with a special, and came while we were talking about it.

Miles Diston didn't realize how bad he was hurt, until he stopped the mogul in front of the general office. So long as the excitement of the run was up, so long as he saw the absolute necessity of doing his whole duty until the desired end was accomplished, so long as he had a reputation to protect, his will power subordinated all else. But Miles was badly hurt, worse than he thought, and when several of us engineers ran up to the engine, we found Miles Diston hanging to the reverse lever by his safety cord, in a dead faint. We carried him into the depot, and one of the doctors administered some restorative, while we got a hack and started him and the doctor for my place, but Miles came to himself, and insisted on going to his boarding house, and nowhere else.

Mrs. Bailey, Miles' boarding house keeper, had been a trained nurse, but had a few years ago invested in a rather disappointing matrimonial adventure. She was one of the best nurses, and one of the crankiest women I ever knew. I believe she was actually glad to see Miles come home hurt, just to show how she could pull him through.

The doctor found that Miles had an ankle out of joint, the little toe was badly smashed, there was a bad cut in the calf of the leg that had bled profusely, there was an awful black bruise over the short ribs on the right side, and a button-hole in the scalp that needed about four stitches. The little toe was cut off without ceremony, the ankle replaced, and hot bandages applied, and other repairs made, which took up most of the afternoon.

When the doctor got through he called Mrs. Bailey and myself out into the parlor, and said that we must not let people crowd in to see the patient, that his wounds were not dangerous, but very painful, he was weak from loss of blood, and his constitution not in extra good shape; the doctor, in fact, thought that Miles would be in great luck if he got out of the scrape without a run of fever.

Miles' case was turned over to old Doctor Black that night, and Mrs. Bailey referred all visitors to me. I talked with the doctor and the nurse a few minutes, and we all agreed that it would stop most inquisitive people, to simply say that the patient had suffered an amputation. That evening when I went home there were two anxious women to receive me, and the youngest of them looked suspiciously as if she had been crying.

I told them something of the accident, how it all happened, and about Miles' injuries. Both of 'em wanted to go right down, and help "do something," but I told them of the doctor's order, and his fears.

By this time the reporters came, and I called 'em into the parlor and let them pump me.

I detailed the accident in full, but declined to tell anything about Miles or his history; "Fact is," said I, "that you people won't give an engineer his just dues; now, if Miles Diston had been a fireman, and had climbed down a ladder with a child, you would have his picture in the paper, and call him a hero, and all that sort of thing; but here is a man crushed, bleeding, with broken bones, and a crippled engine, who stands on one foot, lashed to his reverse lever for eighty miles, and makes the fastest time ever made over the road, because he knew others were suffering for the relief he brought."

"That's nerve," said one of the young men.

"Nerve!" said I. "Nerve! why that man knows no more about fear than a lion, and think of the nerve of the man; this afternoon, he sat up and watched the doctor perform that amputation without a quiver, he wouldn't take chloroform; he wouldn't even lie down."

"Was the amputation above or below the knee?" asked the reporter.

"Below" (I didn't state how far).

"Which foot?"

"Left."

"He is in no great danger?"

"Yes, the doctor says he will be a very sick man for some time, if he recovers at all."

"Boys," said I, "there's one thing you might mention, and I think you ought to, and that is, that it is such heroes as these that give a road its reputation; people feel as though they were safe behind such men."

If Miles Diston had read the papers the next morning, he would have died with flattery, the reporters done themselves proud, and they made a whole column of the "iron will and nerves of steel" racket about that amputation without ether.

Marie Venot felt awful sorry for Miles; she wanted to see him, but Mrs. Bailey referred her to me, and she finally went home, inquiring every day about him. I don't think she had much other feeling for Miles but pity.

She was down a week later, and I talked freely of going to pick out a wooden foot for Miles, who was improving right along.

Meanwhile, the papers far and near copied the articles about the "Hero of the Throttle," and the item about the road's interest in heroes attracted the attention of our general passenger agent—he liked the free advertising, and wanted more of it—so he called me in one day, and asked if I knew of a choice run they could give Miles as a reward of merit.

I told him, if he wanted to make a show of gratitude from the road, and get a big, free "ad," in all the papers, to have Miles appointed superintendent of the Spring Creek branch, where a practical man was needed, and then give it out cold that he had been rewarded by being made superintendent of the road. This was afterward done, with a great hurrah (in the papers).

The second Sunday after Miles was hurt, Marie was down, and I thought I'd have a little fun with her, and see how she regarded Miles.

"There's quite a romance connected with Diston's affair," said I at the dinner table, rather carelessly. "There is a young lady visiting here in town, I hear she is very wealthy, that saw Miles when we took him off his engine. She sends him flowers every day, calls him her hero, and is just crazy for him to get well so she can see him."

"Who is she, did you say?" asked Mrs. A.

"I forgot her name," said I, "but I am here to tell you that she will get Miles, if there's a chance in the world. Her father is an army officer, but she says that Miles Diston is a greater hero than the army ever produced."

"She's a bossy," said Marie.

I don't know whether you would call that a bull or a bear movement on the Diston hero stock, but it went up—I could see that.

A week later Miles was able to come down to our house for dinner, and Mrs. A. asked Marie to come also. I met her at the depot, and after she was safe in the buggy I told her that Miles was up to the house. She nearly jumped out, but I quieted her, and told her that she mustn't notice or say a word about Miles' game leg, as he was awful sensitive about it.

Mrs. A. was in the kitchen, and I went to the barn to put out the horse. Marie went to the sitting-room to avoid the parlor and Miles, but he was there, I guess, and Marie found her hero, for when they came out to dinner he had his arm around her. They were married a month later, and went to Washington, stopping to see us on their way back.

As I came home that night with my patent dinner pail, and with two rows of wrinkles and a load of responsibility on my brow, Marie shook her fist in my face, and called me an "old story teller."

"Story teller," said I. "What story?"

"Oh, what story, that *leg* story, of course, you old cheat."

"What leg story?"

"Old innocence, that amputation below the knee, you know."

"Wa'n't it below the knee?"

"Yes, but it was the little toe."

"John," said Miles, "she cried when she looked for that wooden foot, and only found a slightly flat wheel."

"That's just like 'em," said I, "here Marie only expected a part of a hero, and we give her a whole man, and she kicks; that's gratitude for you."

"I got my hero all right, though," said Marie, "you told me a big fib just the same, but I could kiss you for it."

"Don't you do that," said I, "but if the Lord should give you many blessings, and any of 'em are boys, you might name one after me."

She said she'd do it—and she did it.

A Flue Cutter Kink.

At the Denver Shops of the Rio Grande road they use an old pipe cutter for cutting off and scarfing flues. This tool has the usual hollow spindle and chuck, the dies have been removed, and the tool holder for the cut-off attachment left in place. Into the tool post they put two tools, side and side; one of these is the regular cut-off tool, while beside it is clamped a tool whose end is bent toward the head of the machine; this tool is clamped far enough back of the cut-off tool so as not to interfere with its work. When the end of the flue is cut off the carriage is moved far enough from the end of the flue to let the angled tool pass it, the carriage is moved forward a turn or two of the screw, and the angled cutting tool enters the end of the flue, and scarfs it out neatly and quickly, leaving clean metal. For making safe ends to splice out tubes, the same kind of a rig is used, except that the cutting edge of the angled tool is on the other side. It is run down, and the *outside* of the end of the tube scarfed off, then the tube is run forward to a stop, the cutting-off tool brought down, and the cut completed, the scarfing tool being in position to scarf the next piece, while it is held close to the chuck.

Flues welded in the machine are almost perfect after this treatment, as the weld is made in new, clean iron, the scarfs fitting each other, and no dirt gets into the weld—their loss from bad welds is now almost *nil*. An intelligent laborer who was put on this tool to do the cutting off saw the chance to do the scarfing, and suggested it, and it is to the credit of the foreman in charge that he gets the credit for it.

The Johnstone Compound.

In response to a number of requests for details of the Johnstone compound locomotive as used on the Central Mexicano, we publish the valve and cylinder details herewith.

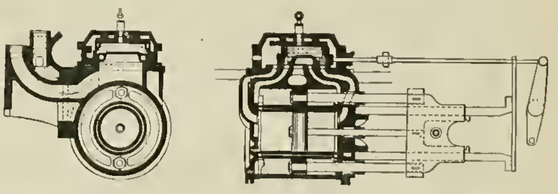
The high-pressure cylinder is inside of the low pressure, the piston of the latter being a ring, and packed inside and outside.

The high-pressure cylinder, which is 14 in. in diameter by 24 in. stroke, is placed within the low-pressure cylinder, which is 30⅞ in. diameter by 24 in. stroke, or equal to a cylinder of 24¼ in. diameter after deducting the area of the high-pressure cylinder and the sleeve surrounding it. The ratio of the cylinders is three to one. The low-pressure piston is provided with two rods and the high pressure with one. The three rods are secured to the same crosshead, both pistons acting in the same direction.

The valve, which is a very important feature of this design, distributes steam to both high and low-pressure cylinders, requiring but one valve stem, which is actuated by the link motion as commonly used on locomotives. The valve is made in two sections, the outer portion distributing steam to the high pressure cylinder, and the inner section to the low-pressure cylinder. The inner section is carried by the outer, and has one inch less travel, the outer traveling six inches, the inner traveling five inches. The object of this is to retard the point of cut-off to the low-pressure cylinder, and also to reduce the compression on the front of the high-pressure piston. When the high pressure admission is cut off at 9 in., the low pressure continues open to the admission of steam for 17 in. The compression on the high pressure piston, which would begin at 9 in. piston travel were both sections of valve made to move together with the same point of cut-off, does not take place until 17 in. in the high-pressure piston and 19 in. in the low-pressure. With 14 in. cut-off in the high pressure cylinder, there is 20 in. cut-off in the low-pressure cylinder, compression beginning at 20 in. in the high-pressure and 22 in. in the low-pressure.

A simple arrangement of starting valves enables the engineman to throw the engine into high pressure, steam being admitted through a reduced opening into the low-pressure cylinders. When this is done the high pressure piston is put into equilibrium, but the two low pressure pistons act with a force equal to two 24¼ in. pistons, therefore the engine has much greater starting power than any high-pressure locomotive of ordinary build.

Several of these engines have been built at the Rhode Island Locomotive Works. The inner valve is not rigidly attached to the rod or main valve, but is loose within the valve cavity and is knocked back and forth by the main valve.



Praise from an Englishman.

At last a real, live English "dook" has given unstinted praise to an American road, and has published the following in an English periodical—1891 is indeed a great year of improvement and advancement.

A more agreeable journey through diversified and attractive scenery than that which can be made by one of the two daily vestibuled fast trains of the Baltimore & Ohio Railroad, between Chicago and Washington, Baltimore, Philadelphia and New York, would be hard to find. The Baltimore & Ohio Railroad of to-day is a vastly different institution from that which it was a few years ago. The antiquated locomotives and cars which then constituted its equipment have given place to rolling stock of the latest and best patterns, and the through trains, vestibuled from engine to rear sleeper, and, including dining-cars and Pullman cars of the most modern and luxurious character, compare favorably with those of any in the world. The sleeping cars, especially built for these trains a few months ago, have some admirable improvements. The elegant simplicity of the interior decorations is in marked contrast to the louder ornamentation which not long ago was considered the height of art in such places. The wood is of mahogany, with little carved or raised work, but brought down to the highest finish, carefully selected for fine grain and texture, and showing highly artistic cabinet work which the eye does not tire of admiring. The improvement in the locomotive equipment is equally remarkable. In order to climb the Alleghanies, from whose heights the passenger enjoys views of sublimity and beauty which he never forgets, heavy grades and numerous curves were necessary in constructing the road, and until recently it required the help of extra engines to get a train to the summit. Now when the foot of the mountain is reached, instead of two or more engines being called into service, there is attached to the train a single engine weighing 67 tons, having six coupled drivers and cylinders 21x28 inches in size, and this powerful machine takes the heavy train up the long stretches of grades, reaching as high as 118 feet to the mile, at a lively pace. The daylight ride over the mountains, especially in the time of verdure, shows a wonderfully attractive panorama, in which grandeur and beauty are constantly mingled, and indeed the entire journey between Washington and Chicago proves the propriety of calling this road "Picturesque B. & O."

Who Can They Trust, Then?

If union meetings serve no better purpose than to permit grand officers to come together and form schemes and intrigues, which always result disastrously for the interests of the railway employes, they had better be abandoned. The editor of the *Gazette* honestly believes that the various railway organizations of this country have more to fear from the schemes and intrigues of the officers who are paid to promote their best interests, than from any other source.—*Railway Service Gazette.*

A Wonder on Wheels.

Some daily paper reporter, presumably just escaped from the incurable ward, or an interview with a division superintendent, gives us the following:

> The Pennsylvania Railroad is building at Altoona an immense locomotive for hauling the limited trains at the necessary speed. It will be more than twice as long, it is said, as the average locomotive, and will have two sets of driving-wheels. The wheels will be under trucks, so that the locomotive can round curves. Two firemen will be necessary.

The conventions of the Master Car Builders Association and American Railway Master Mechanics Association will meet next June at Saratoga, N. Y. Congress Hall has been selected as the headquarters of both associations. The members and all others attending the convention will receive accommodations at the uniform rate of $3.00 per day. Application for rooms should be made to H. S. Clements, Congress Hall, Saratoga, N. Y. The Master Car Builders convention will meet on Wednesday, June 15th, and the Master Mechanics convention on the Monday following.

Woman and the Steam Engine.

It takes sand to run an engine, so it does to run a woman.

There is usually a great bustle about an engine so there is about a woman.

It makes a fellow mad to get left by an engine; so it does by a woman.

An engine is an object of much wonder and admiration to men and of fear to horses, so is a woman.

When an engine goes off the track it usually takes a man or more along with it; so does a woman.

An engine is known by its company, so is a woman

An engine will sometimes blow a fellow up if he puts on too much pressure; so will some women.—*New York Herald.*

Man and the Locomotive.

A locomotive is noisy when she is hot; so is a man

When a locomotive gets too full she lays down; men do

A very old locomotive is apt to be lame; man is the same.

A locomotive's draft is governed by a petticoat, the drafts of men are often affected by the same influence.

On a damp, dark night, a locomotive is slippery and treacherous; man too.

A locomotive, when run by night, should always have a pilot, a man should have two.

The best of locomotives have to be "jacked up" occasionally, and men.

A locomotive that is always out nights soon becomes faded, we have seen faded men.

A dead locomotive has no pull; dead man same.

Locomotives spark nights; so men do.

As a locomotive changes from warm to hot she perspires; and a man.

A locomotive is always hot when there is an "Injin-near"; heap so white man.

Water is good for a locomotive, try it on a man.

A smoking locomotive is a nuisance, man.—*Western Railway*

Don't get a notion that there is forty or fifty per cent. saving of fuel possible with a compound locomotive. The best ones made now may find twenty-five, but the simple engine, or the men who handle it, will be at once improved, so that the compound will have to scrabble to show ten, or, perhaps, keep above five.

Angus Sinclair, secretary, has got out the Master Mechanics Association Report for 1891 with his usual promptness. The work is larger than any previous one, and is ably edited and neatly printed Editing speeches so as to get the cream and discard the whey is a delicate operation, but Angus is an expert skimmer

Secretary John W Cloud, of the Master Car Builders Association, has sent out the twenty-fifth annual report. The book contains 275 pages of text, and plates of all the standards of the association. These reports represent a great deal of hard work by the secretaries, that does not make an extra big show.

L. C Hitchcock's article on Locomotive Running Repairs came to hand too late for this paper; it will appear next month, and the series be finished, we trust, without interruption These articles have been appreciated as much as any other feature of the paper

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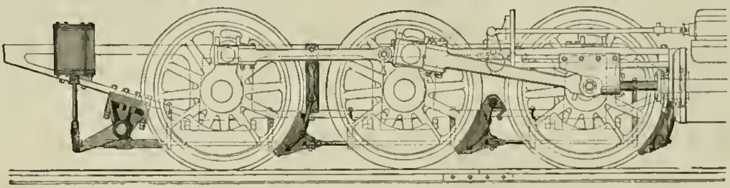

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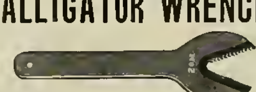

These Wrenches are forged solid in one piece, from best refined iron, with tempered steel jaws. They have ratchet teeth, cut diagonally across one jaw, thus enabling them to bite with three teeth at once.

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THE LOCOMOTIVE ENGINEER.

DEVOTED TO THE SPECIAL INTERESTS OF LOCOMOTIVE ENGINEERS AND FIREMEN AND TO LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 11. NEW YORK, NOVEMBER, 1891. $2.00 per Year or 20c. a copy.

A Stove Train.

The Central Railroad of N. J. have one train that runs semi annually—the stove train. In the spring they start a train out over the road, that collects every stove along the line, from depots, section house, pump houses, switch shanties and what not. This train load of iron is taken to the Elizabethport shops, where the stoves are stored in a building kept for the purpose. During the summer each stove is put in thorough repair, blackened, numbered, and put away. When the October winds begin to move, the stove train starts out again, and peddles out the load it collected in the spring. A gang of competent stove artists put up and take down this array of stoves, thus confining the profanity to a crew who have given up hope, rather than spreading it broadcast throughout the system, as would be done if the stoves were stored under the stairs and the pipe kept in the hen-house—system and organization may yet redeem the world.

A Crippled Confederate.

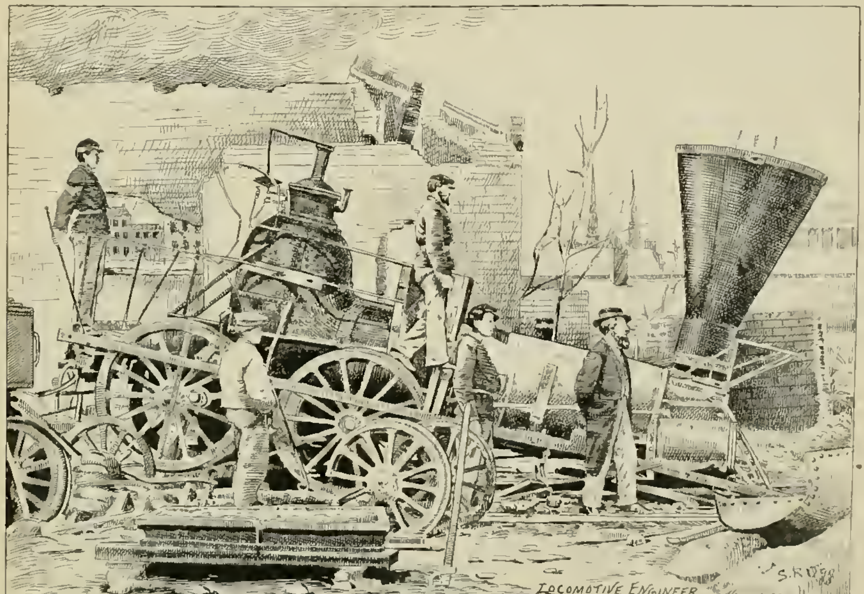
During the war of the Rebellion, from 1861 to 1865, the United States government had two official photographers with the main army, and during the four years of carnage they took some thousands of negatives "at the front." These truthful pictures, painted by the sun more than a quarter of a century ago, have recently fallen into the hands of a company at Hartford, Conn., who are making magic lantern slides and views.

The one shown herewith was taken at the fall of Richmond, at the depot of the Richmond & Petersburg road, and shows the crippled condition in which the Confederate soldiers left the locomotives in the besieged city.

The trucks were taken out and broken up, the rods and motion work stripped off, in fact, everything that could be moved by hand was moved.

The buildings about bear the marks of the victors' shot and shell.

As will be seen, the engine was an eight-wheeler, wood-burner, with a dome, or Bury boiler. Who built her?



A CRIPPLED CONFEDERATE.

The Northern Pacific has brought east from Tacoma, Washington, 180,000 packages of tea this season. This commodity was valued at over $2,000,000, and is always shipped from the seaboard east by fast trains.

All names on our list before Nov. 1st will have their subscription continued by the enlarged paper just as if the price had not been raised; there can be no disappointed subscribers then. All subscriptions for next year received after Nov. 1st must come in at the $2 rate. Subscriptions for all back numbers will be received at the old rate, $1.

The Northwestern have fitted up one suburban locomotive to burn hard coal; this is being done to abate the smoke nuisance. Hard coal will work all right, it's the expense that stands in the way.

Locomotive Running Repairs.

By L. C. Hitchcock.

MOVING ECCENTRICS.

In the September, 1891, issue of The Locomotive Engineer, on page 167, Brother J. W. Keafus asks for information in regard to moving eccentrics on the shaft, and states that in the February number of The Locomotive Engineer, under the head of Running Repairs, I gave no rule by which a person would know how much to move an eccentric on the shaft to give a required amount of lead. I gave no rule, for the reason that the distance an eccentric should be moved on the shaft depends materially on how much throw the eccentric has, and on the length of the rocker arms Different builders making a wide difference in the dimensions of these parts renders the application of any rule to all engines impracticable. From what Bro. Keafus says I conclude that in the case cited the back motion eccentrics were outside, next to the driving-boxes, and also that the eccentrics were not keyed to the shaft. Assuming this to be the case, I should have proceeded as follows: Now this may be called by some a "cut-and-try" way of working, but I think it a quicker way than to have endeavored to figure out a rule to apply to that particular engine After having given the engine the desired amount of lead in the forward motion, I would have placed the reverse lever in the extreme back notch of quadrant, then pinched the engine backward and caught the forward dead center, would then have taken down the back half of the forward eccentric strap, and pushed the forward half with the rod as far forward as possible The top part of the strap would then have rested on the eccentric at about the point A, Fig 1; in this position the set-screws in the back eccentric may be reached. Now, before slacking off these set-screws, scratch a good, plain line $B\ C$ across the lower part of the back eccentric and strap. Now as the eccentric is moved on the shaft the lines $B\ C$ will separate, and on most engines the proportion of the distance these lines will separate to the distance the valve stem will move is about 5 to 1; thus, if the valve stem is to be moved $\frac{1}{16}$" the lines $B\ C$ should be separated $\frac{5}{16}$"; but, as I have stated, no rule will apply to all engines, and this proportion will change as the outside diameter of the eccentric cam decreases by wear.

After having separated the lines $B\ C$ five times the amount of lead I desired, I would have replaced the back half of the forward strap, and pinched the engine forward nearly one-half revolution; then by pinching the engine back would have again caught the forward center, and noted the lead obtained; by carefully noting the amount of lead produced by separating the lines $B\ C$ a given distance, the exact lead could be given at the second trial, if necessary to move the eccentric the second time; then if I was running the engine regularly, and was expected to keep its valves square, I would write down, and keep in a handy place for reference, the proportion of the separation of the lines to the lead produced. It was one of my duties at one time to set the valves of all engines turned out of the Brainerd shops of the N. P. R. R., and to facilitate my work I kept a table of these proportions as required for the different builds of engines. Thus:

Baldwin's = line separation 5 times the lead produced.
Hinkley's = " " 4½ " " " "
Rome's = " " 5¼ " " " "

I do not give this as a correct table, but only to show the manner of keeping it. These tables were made, of course, after having obtained the proper proportion by trial. By this scheme I could give those eccentrics next to the driving-boxes the desired amount of lead eight times out of ten by one trial. A word now in regard to moving eccentrics which are keyed to the shaft. When I was doing this class of work I desired the gang boss in the machine shop to place the eccentrics on the shaft, so that the keyways in the cams came exactly in line with those in the shaft, and hold them in place with the set-screws, leaving out the keys After getting the eccentric rods the proper lengths, I would move the inside eccentrics to produce the desired lead, then move those next to the driving-boxes in the manner here described. After all were in their proper positions the keyways in most instances would appear similar to those represented by Fig. 2. I would then take a small, thin wedge of soft wood about one-quarter the width of the keyway, and place the edge of it against the side of the keyway in the eccentric, then by lowering it bring the thin end in contact with the lip A on the shaft; by rubbing it forward and backward a few times under a slight pressure a clear impression of the width of the lip is made on the wedge.

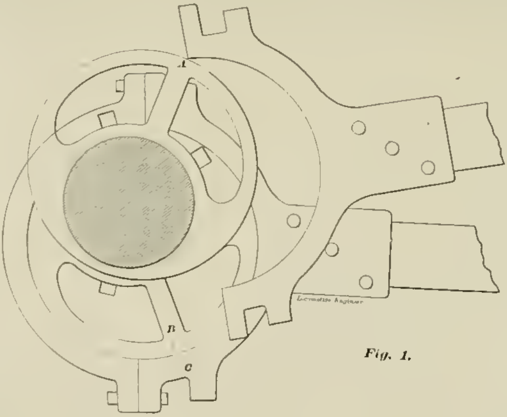


Fig. 1.

This impression shows exactly the amount of offset required for that key.

If a person is careful after having moved an eccentric to go over the work a second time, to insure its being in the proper position, and makes an accurate measurement of the impression of the lip A,

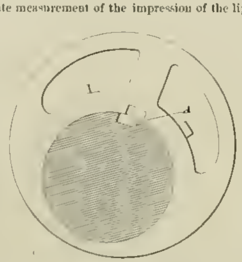


Fig. 2.

and is careful while making the keys, it is but a short job to put in a set of keys, and it will not be necessary to run the engine over in full gear after the keys are in place.

On the Western & Atlantic Railroad—famous for its war memories—down below Dalton, Ga., stands an old car body, now used as a tool-house, bearing on its weather-beaten side this legend, "U. S. Military Railroad, Engineering Dep't." Ah, what stories that old car could tell!

The Journal of Railroad Car Heating has been merged into *The Railroad Car Journal*, with Edward A. Phillips as editor and manager. Its mission in life will be the "improvement and perfection of passenger cars." We heartily wish it success, and wish it would start on the window nuisance.

An Awful Wreck.

"Speakin' o' wrecks," said the old-timer, carefully spreading his coat-tails before the grate and shutting his left eye toward our blonde type-writer, "speakin' o' wrecks reminds me of onct when we was shovin' the mountain division acrost the Rockies, Sam Chambers lenned his ingine up agin a rock slide and piled up fourteen of fifteen cars in a little gulch.

"I were behind Sam with a load of ties and no dinner pail, and laid back and fasted, religious-like, all night. My conductor were from down south somewher's, a keerless-like cuss, and along to'ards mornin' he walked down to the wreck.

"Whilst he were gone the general manager's bob-tail come up behind us and the old man and a few of his gang walked alongside of my train.

"Jest at the engine they met my conductor comin' back.

"'How bad is that wreck?' sais the old man.

"'Bad,' sais Ike, 'awful bad; fact is, it's the worst I ever see.'

"'I had no idee it was so awful,' sais the old man, kinder scratchin' his head and lookin' worried. 'There wa'n't no one hurt?'

"'No,' sais Ike, 'but it's mighty bad, worst——'

"'How many cars?' sais the old man, kinder stoppin' him.

"'Leben,' sais Ike.

"'Leben cars and you a sayin' it's so awful bad. Why, 'leben cars is not much of a wreck.'

"'Worst wreck I ever seen,' persisted Ike. 'Bad, bad,' he muttered, sorter to hisself. 'I never seen a 'leben-car wreck afore where a man couldn't make a raise of a pair of boots or a hat—'leben cars, 'leben great big cars, all mashed to smithereens, and nothin' but ties and coal. Wreck?' sais he, still sorter musin', 'it's a little the d——ndest worst wreck I ever see!'"

In the past ten years the Brotherhood of Locomotive Firemen have paid out $2,704,935.98 Of this, $446,399.75 went for experience in the "Q." strike; the grand amount of $1,875,252 has been paid for sickness and deaths. Those people who howl about organized labor would be a long time collecting $1,875,252 for the widows and orphans of the locomotive firemen of the land The order has helped its members in other ways, raised wages, helped secure positions, added to the *morale* of the membership, and published a magazine of use and interest to its members and their families. It may have blundered, it may have harbored bad hearted men, it may have made mistakes, but from many a widow's heart there goes up a blessing and a prayer for its prosperity. It has made men independent in providing for their families by paying for their protection, and not appealing to charity

---

Recent trials of the Johnstone compound on the Santa Fe road has proven the efficiency of the principle. With a blanket of cooler steam around the high pressure cylinder, and an annular piston packed inside and out, one would be led to expect the least of this machine of all the compounds, but her work proves that "there is something in it"—the compound. We are very much afraid that this engine will be hard to keep up—a good new engine, but a bad old one—but in this we may be mistaken, this compound locomotive business will be settled finally by the "survival of the fittest," and, of course, results being equal, the simplest machine will stand at the head.

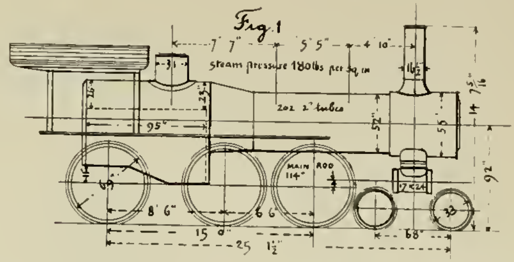
Wm. C. Stroud, one of the firm of Burnham, Williams & Co., proprietors of the Baldwin Locomotive Works, left $200,000 for the establishment of the Eliza Cathcart Home for Incurables, named in honor of his mother.

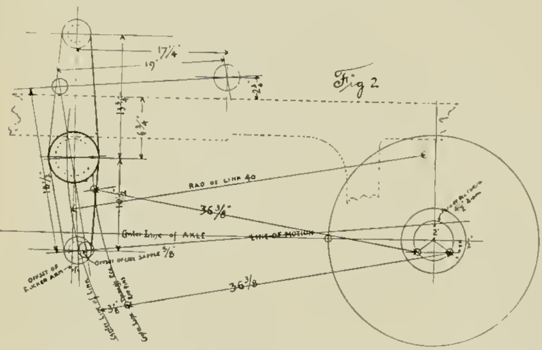
Notes from a Rambling Correspondent.

Cleveland was the first point touched by your correspondent, and here was found quite a busy railroad center

Arriving by the Lake Shore, and having come the whole distance from Buffalo by daylight, a good opportunity was afforded for noting the general features of the road. Any one making this trip cannot help but be impressed with the alignment, freedom from curves and grades, and fine roadbed.

These exceptional conditions admit of safe fast running, which is made good use of in getting the many fast trains over the road. The constantly increasing passenger train loads have called for frequent expansion in the power to keep pace with the growing loads, until the demands upon the power are quite beyond the limit of weight per square inch of journal contact possible in an eight-wheel locomotive. And the next step in the process of evolution was their ten-wheel passenger engines, and Mr. Stevens has succeeded in designing a very superior machine, which satisfactorily meets the growing requirements, and has come to stay. The general features of this engine will be noticed by an examination of the outlined sketch (Fig. 1). One very noticeable feature in this design, which has been the pioneer of a number of the same class, is the location of the rocker arm and link between the forward and main drivers, doing away with the heavy curved rod in common use, and reducing the excessive weight, frictional





resistance and distortion of steam distribution by springing of these long curved rods.

To many of us with old-fashioned notions, this wide departure from our ideal, say 72 inch, eccentric rod, is at the expense of good steam distribution; but the particular difficulty with these short rods, viz.. the inordinate increase of lead as the engine is hooked back, is not so serious a difficulty in fast running engines as in slow freight service, and Mr. Stevens' experience bears out this fact, because he gives unqualified testimony as to the satisfactory and economical service with this class.

Figure 2 is a skeleton outline of the valve motion, which certainly makes a very convenient and compact arrangement

Mr. Stevens, being one of the pioneers in high pressures, has again demonstrated the wisdom of this practice by carrying 180 pounds pressure on these engines.

Next, in looking over the Nickel Plate, we found our friend Mr McKenzie very much up to the times, and the results, upon careful inspection of his motive power, showed that a marked improvement has been made in bringing up the general condition of the power, and some recent engines designed by him are fully abreast of the times. The boilers of these engines deserve special mention, as they exhibit a very ingenious method of doing away with the old-time crown bars and their excessive weight, and also the increased weight of the extended wagon top radial stayed type of boiler, but retain the good features of the wagon top in a novel way by placing the dome on the sloping portion, which extends from the wagon top to the barrel.

And a further improvement is in making this sloping segment a true frustum of a cone, and in one sheet. This produces a radial stayed wagon top boiler, with a minimum weight coupled with maximum strength, and enables all the weight possible to be utilized in making the boiler as large as possible. After a two years' test, these boilers speak for themselves. The writer was also interested in the method of compactly classifying the power on this road, an outline of which is given in the table below.

Also at Cleveland we had the pleasure of meeting Mr. John Bean, the genial Superintendent of Motive Power of the Cleveland & Canton Railroad. His road is a very busy coal road, with heavy traffic for the physical condition of the road, and is very hard upon the power, but from the results accomplished Mr. Bean has good reason to be pleased, as the general condition of the rolling stock is very good.

At Detroit, the home of the Michigan Central, there were no special features, but thrift is apparent on every side One is especially impressed with the improvements in the passenger cars, but we did not find the motive power quite as modern as we expected. At the same time this road is endeavoring to find the ideal type of passenger engine for their service, and this point led them at a very early day to the use of the ten-wheel passenger engine, and very fine specimens of this type the road has now in service. Besides these, they have two compounds, which, all things taken in consideration, are of the most successful type in use, as they have been in constant, active, every-day service for a considerable time, and, necessarily, these people, having used this type longer than any one, are better prepared to speak concerning the merits or demerits of this system. So far, these engines have shown a decided economy. Thanks to the courtesy of the General Master Mechanic, Mr. Smart, we were afforded an opportunity to ride on the compound, hauling the North Shore Limited, from Jackson to Detroit, 75½ miles, schedule time of this train being 1 hour and 48 minutes, or 42 miles per hour, including two stops. After a run of 38 miles the forward high-pressure cylinder head blew out. The train was immediately stopped, the main rod taken down, piston and valve stem disconnected, and pushed to forward end, securely blocked, and the intercepting valve blocked open, and the train hauled in with a low pressure cylinder. Query: Was it necessary to have done anything with the intercepting valve?

At the Jackson shops they are turning out unusually good specimens of boiler work, besides doing a good deal of general repairs. Mr Smart's efforts and plans for furnishing every facility for educating his engineers and firemen, and the provisions for instructions in drafting for the shop apprentices, is deserving of special mention. P E. L.

The present stock of bound volumes of THE LOCOMOTIVE ENGINEER, and handy binders for home binding, will be sold out and no more made. We can supply papers from the beginning of the publication—four years. Orders for bound volumes will be placed on file, and copies sent out while the stock lasts. Get yours in early.

We will give 25 cents each for 100 copies of March, 1890 issue. Must be clean enough to bind.

CLASSIFICATION OF ENGINES.

THE N. Y. C. & ST. L. R. R. CO.

Class	Service.	No. of Engine	Cylinder.	No of Driving Wheels.	No of Truck Wheels	Weight in Working Order — Engine — On Drivers	Engine — On Truck	Engine — Total.	Tender Loaded.	Engine & Tender Total. — Pounds	Engine & Tender Total. — Tons.

Class	Wheel Base. — Driving	Wheel Base. — Total Engine	Wheel Base. — Total Engine and Tender	Wheel Diameter — Driving Center.	Wheel Diameter — Truck	Brakes — Westinghouse Automatic on Tender and 6 Drivers	Westinghouse Automatic on Tender and 4 Drivers.	Westinghouse Automatic on Tender Only.	American Steam on 4 Drivers	Surfaces Square Feet — Grate "G"	Heating "H"	Ratio "G" to "H"

It's a good deal of a relief and a change from the usual to pick up the bill of fare on a Santa Fe diner, and read this legend "No fees. Please do not deteriorate our service by bribing the waiters—all money left on the tables will be turned in to the company." The Santa Fe employ white waiters, have the finest cars and the best service in the country.

Where They Are.

The following list of the railroad mileage by States shows the location of our iron paths. As will be seen, the West leads by far; in a few years Texas will lead, with Illinois and Kansas close behind her, while New York and Pennsylvania will slip down the list to near the middle.

1	Illinois	10,129	9	Missouri	6,142
2	Kansas	8,900	10	Indiana	6,106
3	Texas	8,710	11	Wisconsin	5,615
4	Pennsylvania	8,710	12	Minnesota	5,545
5	Iowa	8,415	13	Nebraska	5,407
6	Ohio	7,988	14	Georgia	4,593
7	New York	7,748	15	California	4,356
8	Michigan	7,106	16	Colorado	4,291

Standard Brakes and Car Couplings in India.

The last official report concerning the railways of India has the following items:

"During the year under review 57 locomotives and 178 vehicles on the Northwestern Railway were fitted with the vacuum automatic brake gear, and passenger trains so fitted have been running on the Sind-Pishin section since November, 1890.

"On the East Indian it is proposed to fit up 18 engines and tenders and 87 vehicles with vacuum automatic brake gear, and 34 vehicles with pipes only for working the suburban and vice-regal trains. Also to fit up 34 engines and tenders and 130 vehicles with vacuum automatic brake gear, and 100 vehicles with pipes only for the chord and loop line mail trains, and joint stock for through service with the Great Indian Peninsula.

"On the Great Indian Peninsula 63 locomotives and 64 vehicles have been fitted with the vacuum automatic brake.

"Two locomotives and 15 vehicles are already fitted with the vacuum automatic brake on the Eastern Bengal State railway.

"On the Oudh & Rohilkhand the government of India has sanctioned the provision of continuous vacuum automatic brakes for the locomotive engines and passenger stock used on the mail trains of the line.

"All standard gauge lines in India, with the exception of the East Indian, have screw couplings at both ends of all their passenger stock. The East Indian company is now providing second screw couplings to the joint passenger stock of the East Indian and the Great Indian Peninsula railways, as well as to postal vehicles.

"A committee of locomotive and carriage superintendents for India has been formed, with a view to the introduction of a system of standard patterns."—*Indian Engineer.*

Ninety-two Miles in Ninety-two Minutes with Four Stops.

Ninety-two miles in ninety-two minutes is fast traveling, and, all things considered, is worthy of special comment, even among the feats recently accomplished on the "rapid transit" line. This run was made by a Royal Blue train on the Baltimore & Ohio Railroad on Sunday, Oct. 4th, without any preparations for the event. The train consisted of a combination car, two passenger coaches, and the Pullman parlor car "Dahlia." It was in charge of Conductor L. H. Bender, and drawn by locomotive 853, built at the Baldwin works, mate to the one illustrated in this paper in May last, with Engineer J. W. Hanson at the throttle.

The train left Camden station on scheduled time, 8.50 A. M., reaching Locust Point a few minutes later. There its progress was blocked by a fire at Elevator A, directly alongside of the ferry slip. The heat was so great that General Agent Beeler was afraid to let the transfer boat enter the slip, being confident that if he did so the boat would catch fire and cause a panic among the passengers, of whom there were a large number, and perhaps possible loss of life would ensue.

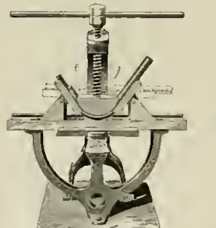
Finally, the transfer boat was taken to the wharf of Elevator "C," the passengers put aboard and carried to Canton.

The run from Canton to Newark, Del., 54.4 miles, was made in a little less than 56 minutes, including a stop of about two minutes at Bayview Junction. From the latter point to Newark no stops were made. From Newark to Philadelphia, 37.2 miles, the time consumed was 36 minutes, including stops at Wilmington and Chester. A part of the time the train was run at a speed of 72 miles an hour.—*Baltimore Paper.*

The Brownson Pipe Bender.

The illustration on this page represents a handy and efficient bench tool, the invention of Mr. G. B. Brownson, foreman coppersmith of the St. Louis & San Francisco shops at Springfield, Mo.

With this device, finished copper and brass pipe, as well as ordinary iron ones, are bent to any de-



sired angle and with any desired radius, without filling of any kind and without flattening the pipe at the bend.

As will be seen, the pipe is laid across two curved blocks, as shown in the dotted lines, these blocks rest on hinges which are fast to movable rests. The distance apart that these rests are placed determines the sharpness of the bend.

The power is applied by a screw, as shown. The whole device is simple and easily operated.

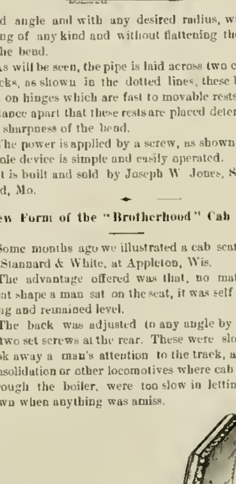
It is built and sold by Joseph W. Jones, Springfield, Mo.

New Form of the "Brotherhood" Cab Seat.

Some months ago we illustrated a cab seat made by Stannard & White, at Appleton, Wis.

The advantage offered was that, no matter in what shape a man sat on the seat, it was self equalizing and remained level.

The back was adjusted to any angle by means of two set screws at the rear. These were slow and took away a man's attention to the track, and for consolidation or other locomotives where cab comes through the boiler, were too slow in letting seat down when anything was amiss.



The new seat, shown herewith, has a ratchet and pawl on the seat that enables the engineer or fireman to instantly let the back down to any angle or entirely flat.

These seats are very strong, occupy little room, and are a source of great comfort to a class of men who need all the comfort they can get. The back and cushion are covered with horse hide, which is very serviceable, lasting and easy to keep clean.

The London, Brighton & South Coast Railway have tried for twelve years to use electric lights in their cars, but have at last given it up and put in the Pintsch gas system.

Wonders will Never Cease.

A convict in the Massachusetts State Prison has recently invented a marine engine which entirely revolutionizes all those of previous makes. It is stated that no eccentrics are used, that it can be reversed without slacking the speed, this action being done by pressing a button on a small or medium engine, while on large ones a treadle is substituted. But three valves are utilized, and they are self-acting. There is no steam chest, and no steam can get into the cylinder. It is claimed that it is more powerful and capable of more speed than the Corliss, and, owing to the dispensation of a large percentage of the friction, there is less expense attending it. He is also at work upon an improved fire engine. A well-versed mechanic states that there is no other cylinder like that used in this case in the world.—*Manufacturing Gazette.*

An engine that can be reversed without slacking the speed, let alone stopping it, and one without a steam chest, is wonderful, and the cylinder into which steam cannot enter will be handy for the engineer to carry his lunch in, or, perhaps, to keep the monkey-wrench and dope bucket.

Not Unreasonable.

Among the better class of roads a movement is on foot to make parlor cars more pleasant to travel in. These cars, if first-class, cost \$20,000 to \$25,000, and it is proposed to educate the traveling public, more especially the male part, up to being better mannered. The educators are willing that a man should make himself comfortable, but he must pay more attention to the little civilities of travel. In a parlor, or even a sitting-room, no man would think of sitting for hours with his hat on in the presence of ladies, nor would he push the spittoon into the middle of the room and expectorate tobacco juice in it at the rate of a pint an hour. The position is taken that man can travel just as comfortably and act as a gentleman should in the presence of ladies.

Economy in Rain.

According to a reputed statement of Mr. Robert Hill, chief engineer of the Chicago City Cable Railway Co., the power required for the operation of the system on rainy days, when the tracks are wet, is fully 20 per cent. less than on dry days, and at the same time it is estimated that fully 25 per cent. more passengers are carried at such times. This gives a very large showing in favor of wet rails where the cable traction is used and the adhesion between wheel and rail is not depended upon for traction. Under these circumstances, rainy days must be a greater blessing to the cable roads than we supposed. It is a fact generally appreciated that the nickels taken in on such occasions are more numerous than on fine days, but that the increased traffic at such times should be carried at a reduced cost is very much of a good thing for the stockholders. Nature evidently smiles upon them.—*Ry. Review.*

The economy will probably be found in the fact that rain does away with a great deal of the sand and dirt on the rails, making the cars pull easier. A *damp* rail is a slippery footing for a locomotive, but a driving rain makes them take hold far better than they do on a dry rail. Water in place of sand has long been used on mining locomotives where much fine dust covers the rail. Next to oil, dust, coal or charcoal dust especially, are the slipperiest things a locomotive strikes in her travels.

Romance in the Office—Reality in the Cab.

On October 15, three reporters who had been sent out by the Chicago *Inter-Ocean* to write up an account of a midnight trip in the cab of a fast express engine, on the Chicago & Eastern Illinois, were killed.

An open switch threw the flying train into an old roundhouse at Crete, Ill. The engine turned over and the roundhouse collapsed, killing the engineer and the three reporters. The fireman escaped.

Zero weather in October made the boys think of covering up the slot around the reverse lever and getting up the side curtains.

A New Molding Machine.

Some time ago we made mention of an ingenious and simple molding machine invented by Harris Tabor, inventor of the steam engine indicator which bears his name, and manufactured by the Tabor Manufacturing Co., 111 Liberty street, New York.

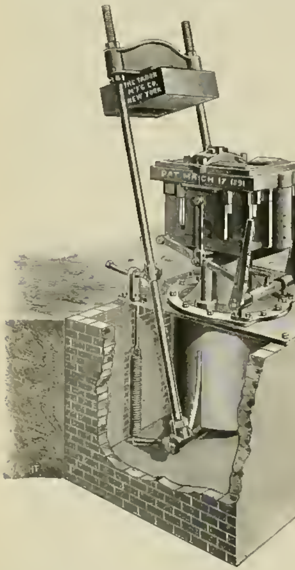
Labor-saving tools are always of interest, but there are few made for molders or for foundry use

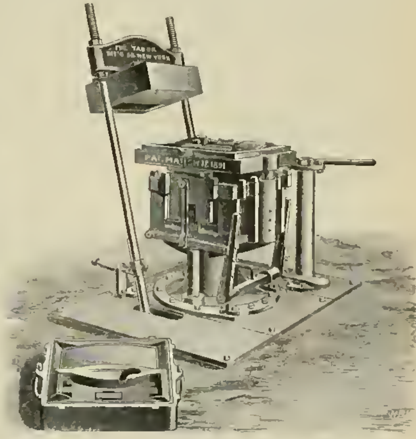
The machine illustrated herewith is a small one, capable of handling patterns that go inside of a 14x17-inch flask

The inventor furnished the following description:

The cuts show the machine in the foundry as set for work, with the floor cut away in one case to show the arrangement of cylinder below. The piston takes steam on the under side only, its weight being sufficient to return it promptly after ramming the mold. The piston rod projects through suitable length, which engage the ends of the levers on the downward motion to draw the pattern. The ramming head is carried on the strain bars at the side, which are trunnioned on a shaft below, and bolted to the cylinder Springs are connected so that as the head is moved backward the springs are put in tension and made to counteract the weight The ramming head is usually of wood, roughly cut out over the pattern, to avoid too hard ramming on the high places This block may be readily changed to suit any size flask not beyond the capacity of the machine The stops on the tripping arms can be changed to suit any draft within the range of the machine. The steam pipe enters the machine at the bottom, and from the throttle to the cylinder serves as exhaust pipe.

The operation of making the mold is simple. The half flask is put on the machine, with the sand box as an extension, to hold the sand that is compressed, and both are filled with sand, when the ramming head is brought up over the flask, and against stops, to prevent it going too far, and the throttle valve opened; the upward motion carries the sand up against the ramming head, and the sand is compressed to the top of the flask; the throttle is then closed, the same motion opening the exhaust, and the flask descends, the stops in the meantime engaging the free ends of the levers, which reduce the downward motion of the stripping





A NEW MOLDING MACHINE

the cylinder head and supports the upper part of the machine, which consists of a table with lugs projecting upward and supporting the pattern frame upon which rest the patterns; the stripping plate frame, directly over the pattern frame, and resting on it, to which the stripping plate is attached; the stool plate, suspended to the stripping plate frame and moving with it, side levers and tumbling shaft for tripping after the pattern is drawn. The pattern frame has an annular passage connected to the steam in the cylinder by means of a pipe extending through the piston rod The object of this passage is to keep the patterns warm, to prevent sweating, and to assist them in drawing from the sand The stripping plate frame is guided in two bored sockets in the front and back of the machine, these sockets have air holes to cushion the drop of the stripping plate frame after it is tripped The stool plate is really a part of the stripping plate frame below the pattern frame, and its object is to support stools or internal parts of the stripping plate used in holding green sand cores or heavy bodies of hanging sand when the pattern is drawn. The side levers are pivoted at one end to the table, and are connected in the middle, by links, to the stripping plate frame, the outer end being free. The tumbling, or tripping shaft, is in front, with arms projecting upward along the line of travel, followed by the free ends of the side levers; on these arms are stops of plate one-half, while the motion of the pattern is not arrested, when the piston has finished its descent the pattern is drawn, the ramming head is then turned back, the sand struck off the flask, and the flask ready to be taken from the machine As the operator lifts the flask from the machine he steps on the treadle attached to the tripping shaft, which disengages the stops, and the stripping plate drops noiselessly to its place, and the machine is ready for another half flask The operation of making the mold is very quick. The writer has seen a complete half mold, as shown in the cut, made by one man in 10 seconds after the sand was in the flask This time included taking the flask from the machine and putting on the floor for inspection.

This machine uses steam, but air or water can be used, steam is preferable, as it warms the patterns and keeps the whole machine in better working order, besides being cheapest The machine shown is at work on standard Christie brake shoes—making two at a time—and at the rate of about 25 per hour, worked by a man and a boy, who shovel their own sand Where a large number of duplicate parts are used, as in car works, etc, the machine is an economizer

The motive power and car departments of the Concord division of the Boston & Maine have been consolidated, and Mr. Charles H Wiggin placed in charge, with the title of master mechanic

On Oct 8th Judge Barrett imposed a fine of $7,000 on the New York, New Haven & Hartford, for violation of the Passenger Car-heating Act. The suit, which was regarded as something of a test case, was brought by the Attorney-General, and was the result of the recent tunnel accident, in which a number of persons were burned to death by the stoves in the cars. The defense of the New Haven Road was that, it being partially a Connecticut corporation, did not come under the jurisdiction of the New York State laws. This matter should be pushed, not only on the road in question, but on all roads Car stoves, hand-brakes, and running "by smoke," are things of a past age We want steam heat, automatic air-brakes, and absolute block signals—and we want them bad.

The Great Western Railway, of England, was the leader of broad gauge lines there, and its main line is to-day seven foot gauge, and the rails laid on heavy timbers which in turn rest on cross-ties. The directors of the company have just voted to adopt the standard gauge of 4 foot 8½ inches, on account of the interchange of cars. Two thousand years ago the wheels of Roman chariots were 4 feet 8½ inches, and it came down to us in stages, and seems bound to stay with us to the end, the only thing that threatens to get away from it is the flying machine—and we are not sure about that

French engine drivers and foremen are hereafter to be recruited by the railways of France according to rules and requirements of fitness fixed by the Minister of Public Works, M. Yves Guyot In an official circular just issued, M Guyot calls the attention of managers of railways to the fact that the law of November 15, 1810, distinctly states that "No one can be employed as an engine driver unless he produce certificates of capacity filled out according to forms determined by the Minister of Public Works" This law has not been enforced until now, as it was deemed essential to first make uniform, on all the railway systems, the signals to be used, and to otherwise improve upon the practice on these roads. This uniformity of practice is now an accomplished fact, and the minister believes that the time has come to enforce the old law, in the interest of the greater safety of travelers He therefore demands that each manager inform him as to the rules in force on their lines in this connection, how these mechanics are recruited or trained, and what are the conditions of fitness required for service He wishes them at the same time to send in such suggestions as they see fit for a standard set of regulations covering the points in question.—*Ex.*

The Richmond Locomotive Works had a slight fire in their foundry on the night of October 14th, but it in no way interfered with the work

Consolidation Compound Locomotive for Heavy Gradients, built by The Schenectady Locomotive Works.

The question of the application of the compound principle to locomotives in heavy service for both passenger and freight traffic, becoming so prominent with various roads, the Schenectady Locomotive Works, who have already built a number of the two-cylinder type, which are giving excellent results, have designed the heavy compound consolidation engine illustrated and described in our present number. The general dimensions of the locomotive, as will be seen by reference to specification, are very similar to the 22"x28" consolidation engines on the Union Pacific, which we believe are the largest and most powerful locomotives at work in regular road service at the present day. The compound locomotive has cylinders arranged for giving the same power as the simple 22 x28 cylinders, and the proportion between the high and low-pressure cylinder is that found to be the most economical on other compound engines built at the Schenectady Works. Although the low-pressure cylinder is exceptionally large, being 32 diameter, the extreme distance outside of cylinder does not exceed that of other two-cylinder compounds now running, as the centers of the cylinders are carried toward center of engine, the frames being placed 45' from center to center, and the lower rail of frame being depressed where attached to cylinder. As will be seen, ample bearings are provided for crosshead, rods and axles. The cut of the engine shows location of the new intercepting valve which has been used on all of the compound engines recently built at these works, and which is giving excellent results, enabling the engine to start more promptly than the simple locomotives, and entirely eliminating the possibility of the engines "balking," as has been reported to the discredit of some of the compound locomotives now in service. The intercepting valve is entirely automatic so that the engineer has no more care in handling the compound than a simple locomotive

As will be seen, the claims made by the designers for simplicity are demonstrated, there being—aside from the intercepting valve—no more parts on this exceptionally heavy engine than on any simple consolidation.

The design demonstrates the fact that the popular two-cylinder type of compounding can be applied to the heaviest locomotive in road service at the present time.

The circular issued some weeks ago by the Lake Shore management, strictly forbidding the use of intoxicating drinks by employes, has given offense to many saloonists, who will, it is said, boycott the road wherever possible.—*Ex.* Let 'em; we wish they wouldn't let a trainman come into their saloons.

During the year ending June 30th the Manhattan Elevated Road carried 196,714,199 passengers, an increase of 10,880,567 over the year before.

All subscriptions that do not begin with January will have to be supplied with two sizes of paper—the new form of *Locomotive Engineering* will be four column—those who desire it can have back numbers of 1891 to complete their year

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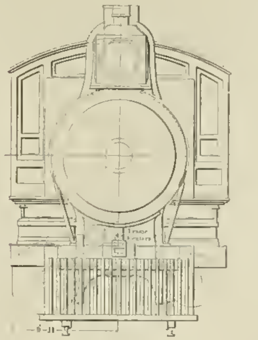
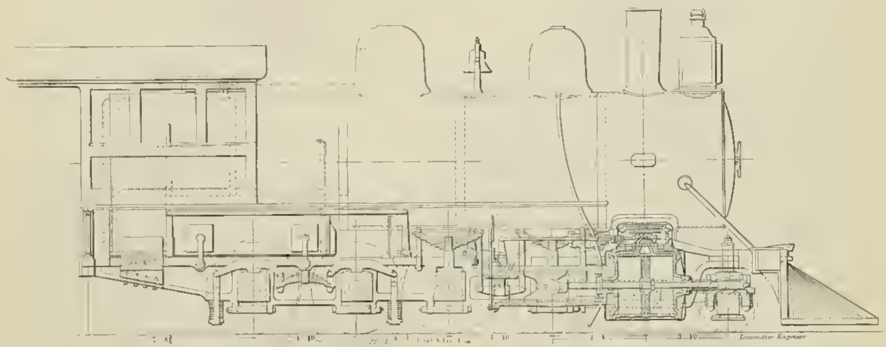
A dollar's worth of rubber or felt weather strips on the cab doors and windows will keep out about four dollars' worth of wind a day—and it will last all winter. Every road should supply the strips if they do not apply them.





CONSOLIDATION COMPOUND LOCOMOTIVE FOR HEAVY GRADIENTS.

Correspondence

Another Story of Old Betsy.

Editor The Locomotive Engineer:

The cut of the odd looking locomotive on front page of the October number looks just like the engine it represents, but it does not look at all like the one it is said to represent, namely, the "Betsy"

The locomotive shown in the cut is the "Visalia," built by the Vulcan Iron Works in San Francisco; her drivers are single plate driving wheels Any one who has seen the old Norris engine, Wm. Penn, about the Sacramento shops, will remember her having a pair of the same kind of drivers; they are a grand humbug about oiling. Mr. Brennan speaks of the so-called Betsy running from the junction of Valencia St.; it should read (from the junction of Valencia and Market), to Point Lobos.

If the writer knows anything about the topography of San Francisco, Point Lobos is a telegraph station out near "The Heads," or the Golden Gate. If a railroad ever ran out there I never heard of it before; furthermore, don't know what a railroad to Point Lobos would be used for, at the time this engine was built Claiming to know the history of the true Betsy, I want to tell it. When the S P. Co. got control of the Santa Cruz & Watsonville narrow gauge road they made a standard gauge road of it; soon afterward the writer was sent with a gang of men to Pajuro (pronounced Paharo) to load up the narrow gauge rolling stock and send it to San Francisco. The company had some interest in the Guatemala Central, and the rolling stock was sent to that country

After we got through at Pajaro we went to Santa Cruz to stay over night, and returned to Aptos the next morning. Aptos is the junction of the Loma Prieta branch It was at this place we found the true "Betsy" She was a diminutive specimen of a four-wheel locomotive built by the Pacific Iron Works, in San Francisco, and run by a tall, lank, old man named Pope, if I remember right—as in most cases the smaller the engine the larger the engineer

The Betsy had finished her work the evening before, and on our arrival there in the morning we found this poor, little, insignificant locomotive decorated with calla lilies and other beautiful flowers, as a floral offering to some loved one about to be laid away to their eternal rest. This was the work of a few children living near-by. The children along the line of the road loved this little engine, and often while switching they would follow her back and forth as though she was some animate being and they wanted to help her do the work in hand. The little engine looked very much like the Mulholland narrow gauge engine on page 199 of THE LOCOMOTIVE ENGINEER. When we started to load her on a flat car, some of the hands wanted to take the flowers off, but the writer, having charge of that part of the work, would not allow a flower to be removed. We deposited the remains, flowers and all, in the narrow-gauge engine-house at Pajaro. Whatever became of the little engine the writer never knew. This is the story of the true "Betsy."

Corry, Pa W DE SANNO.

Criticism of the Critic.

Editor The Locomotive Engineer.

A great deal of space has been taken up in your columns by Mr W. de Sanno He makes comments on the merits (or demerits) of certain classes of railroad employes, which I think unjust.

To commence with, he quotes some firemen out his way who did not know what a petticoat pipe was, and then decides that such men could not make successful engineers. Now, Mr. Editor, I have fired on one of the roads that run into Pittsburgh for three and a half years, and although I have a knowledge of the uses of a petticoat pipe, I have never seen one on any of this company's engines (something near 500). They all have high exhaust pipes with double nozzles. There are some men on this road—P., C., C. & St. L.—who probably could not say much about petticoat pipes, who, I think, could give Mr. de Sanno a few pointers.

Regarding the learning of examination questions parrot-like, it seems to me that it would be much harder than a study of the different parts of an engine.

A railroad man *would* have to draw very hard on his imagination to believe an engine would run with *nothing* to keep a side rod on. What was the collar on the main pin doing, anyhow? I know an instance where a collar was lost off a main pin on a consolidation engine (class 8) and run eleven miles before it could be replaced; part of the distance—about seven miles—was down grade, and at the rate of at least 40 miles per hour. There was not enough lateral motion of the main rod to make it rub the guide yoke.

About flagmen. If the majority of flagmen were like de Sanno's ideal, it would not be safe to railroad. While we read occasionally of one shirking his duty, yet the many thousands of trains that pass safely across this continent show beyond doubt that our brethren, the flagmen, are not all to be slandered. There are times and places on all roads where flagmen do not find it very pleasant. I heard one saying the other day he did not feel altogether at ease when standing for hours at night at the place where a few days before his friend had been killed. There are cases where flagmen have been found dead on the track "Killed while sleeping on duty" is what some may think, when probably the circumstances suggest assault, robbery, and a sure way of hiding the facts by placing the victim on the track. Let us do them justice; if they fail in their duty they are soon dropped De Sanno's idea of compelling men to do anything will not work His scheme of a box key, ticket, etc , is only a modification of a system illustrated in a June issue of *The Scientific American*.

I was pleased to note the stand taken by your correspondent, T W Benjamin, of the Burlington, and W. C. Parsons, of Texas, which ought to show any ordinary person the advantage of darkening headlights. The glare of a headlight once prevented the writer from observing an engine backing down a grade while we were backing up the same track with light engine; both engineers took the same signal—result, two tenders completely ruined, and the writer a sore foot This was before the adoption of headlight curtains on this road. There is no doubt that the rule of darkening headlights on side tracks was adopted, with others, for safety, after careful consideration, and is a step in the right direction. JOHN BRUCE.

Pittsburgh, Pa.

What Became of this Device?

Editor The Locomotive Engineer

I should like to hear whatever became of H Chamfield's double exhaust valve. It was gotten up at Susquehanna, on the Erie, in 1880 At that time F. M Wilder was Supt. of M P

The engine equipped with this device "led the chase" in those days. I should like to see some indicator cards taken from her at 25 miles per hour —Mr. Wilder was a champion card faker. Some of the Prays of to-day would be interested, for getting rid of the steam seems to be the mountain in the way yet. PROGRESS.

Garrett, Ind.

An Air-brake Question.

Editor The Locomotive Engineer.

Would like to ask an air brake question · I was running an engine on the Park & Ocean R. R , San Francisco; we had the automatic system Sometimes while switching, the driver-brakes would jump on without any action on my part, and the brake would not release; at other times it would set while the engine was standing still, and it was not a gradual setting of the brake, but suddenly, and could not be released except by bleeding I spoke to the air brake company's man about it, but received no information or explanation , also spoke to the M. M., Jack Wilson, but he told me I did not know how to handle it , that was his way of getting out of it. Now what was the trouble? I never could find out. W DE SANNO.

Corry, Pa

Air-pump Capacities, and the Lift of Valves.

Editor The Locomotive Engineer :

I have read with interest two or three articles in THE LOCOMOTIVE ENGINEER lately on air-pumps, lift of air valves, etc. One writer says ⅛ lift for receiving valve, and $\frac{1}{16}$ for discharge valve; this is right for the 6' air-pump, but for 8 air-pumps the receiving valves should have $\frac{3}{32}$ lift, and discharge valves ⅛ lift, so says Westinghouse instruction book, page 11—and that is good authority.

This book is a valuable work, and should be in the hands of all air brake men, as it gives all information concerning pump, train signal, apparatus, engineers' brake valve, old and new triple valves—that is, old style and quick action—Hodge and Stevens' system of brake levers, the Master Mechanics Association's standard of brake rigging for freight and passenger cars, sizes of all bolts, pins, etc , used in the construction of brakes in the Westinghouse system, with many valuable plates, with a chapter or little book entitled "Don't," telling what an engineer should not do; and it is a good thing to know what you should not do sometimes as well as what to do

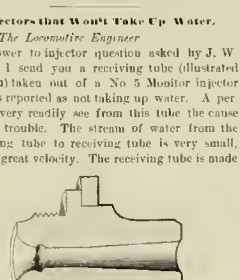
I should have said when speaking of air-valve lift that with 125 pounds of steam pressure an 8 pump in good condition should compress nine cubic feet of air to a pressure of 70 pounds in 88 seconds, and from 20 to 70 pounds in 62 seconds The efficiency of the pump may, therefore, be readily ascertained at any time desired. If other reservoirs are used of a different capacity, the duty of the pump may be calculated in the same proportion. FRED B. ARMSTRONG

Camden, N. J

Injectors that Won't Take Up Water.

Editor The Locomotive Engineer

In answer to injector question asked by J. W Kaefus, I send you a receiving tube (illustrated herewith) taken out of a No 5 Monitor injector that was reported as not taking up water. A person can very readily see from this tube the cause of such trouble. The stream of water from the combining tube to receiving tube is very small, and has great velocity. The receiving tube is made



flaring-mouthed, to receive this stream. All the water which this tube cannot receive goes to overflow. As you can see by this tube, the water has worn a very large cavity in the mouth of it The water now striking this is diverted from its direct course, and some of it returns to overflow. This is probably the cause of Mr Kaefus' trouble although it may be that the steam is cramped either in valves or pipes between boiler and injector, causing a supply insufficient to siphon water from bottom of tank, and then to force it against boiler pressure, while with a full tank it would not need as much steam to siphon, leaving more to force.

New York City. R. B. READING.

A Nut for Air-brake Manipulators.

Editor The Locomotive Engineer :

I had a little experience with air-brakes a few months ago that it might do engineers and firemen good to think over One night we were waiting for orders at the summit on a western road, and as the grade for the first six miles is more than 200 feet in some places, a fireman's anxiety oftentimes runs very high, especially if there are new brakemen on the train, which was the case this night I kept my eye on the brakemen for some time, and finally came to the conclusion they were not going to examine the air brakes, so I called the head man and told him what was necessary in order that we have a safe ride down hill. "It was news to him" I therefore exhausted thirty-five pounds of air out of the train pipe, sufficient to set all brakes full, for we were only carrying ninety pounds The brakeman and I then started for the rear of train, giving every brake beam a kick to see that all were set, when we reached the caboose there were only two cars in the train of fifteen that had brakes set on them, and these were the two head cars

Thinking there was a stop-cock shut, I opened train pipe on rear of caboose, and air came out.

We returned to engine, I recharged, and allowed one minute for auxiliaries to fill up. I then placed engineer's valve on lap, and told brakeman to open train pipe on rear of caboose, while I stood eight cars back along the train; when train pipe was opened I thought every brake beam in train was smashed, for the quick action got its work in in good shape, and fortunately only one brake was damaged

I again recharged, but could not set the brakes from the engine, but could set them from rear end every time. The engineer and conductor, after getting orders, came around to go, but found that the pump was stopped, and the fireman and brakeman looking for the trouble

Everything was O. K. on engine, the trouble was between forward end of head car and rear end of caboose. What was the trouble. G J. H.

San Bernardino, Cal.

Study of Water-brake Diseases.

Editor The Locomotive Engineer

The water-brake, as used on American locomotives, is one of the most unsatisfactory subjects I have ever undertaken to study up. Am very glad J. W Kaefus has again started the ball rolling , and am going to give a guess as to the cause of his Baldwin engine throwing water intermittently.

It is a fact that the exhaust cavity in the saddle, in passing from exhaust port to nozzles, passes entirely below these two points, also that the exhaust cavities carry a large amount of water before becoming entirely filled, or before the level of the water rises to the exhaust port or nozzles.

All engines running forward, reversed, have a "grunt," caused by the release, through the exhaust cavity, of a portion of the air compressed by the reversed action of the valve and the piston. Now, when Mr. K reverses his engine and puts on the water-brake, this cavity commences to fill. When it is partly full it does not interfere with the exhaust of compressed air , but when the cavity is entirely full then this exhaust throws the water out of the stack, and it again begins to accumulate for another discharge At the same time, some of this water goes to the valve and cylinders, showing at cylinder cocks

According to my idea, no water should strike valve or cylinder for water-brake to work successfully Whenever water shows at cylinder cocks there is too much water

It is a fact that water on valves and cylinders through throttle valve is bad , now why not as bad if it comes through water-brake valve? This is the same experience Mr. K speaks of with one of the McQueen engines. Of course, when an engine's valves have been washed with water (whether it comes through priming or water-brake valve) the reverse lever will pull you off the seat What you want to show at cylinder cocks is steam, not water There is no harm in running with cylinder cocks closed They can be opened once in a while to see that the steam shows right. If the discharge shows blue, there is not enough steam or water. It shows that hot air and smoke are being sucked back into the cylinders, and that the action of the valve oil is being destroyed.

Water from a boiler carrying 160 pounds of steam has a temperature of several hundred degrees, now this water, being released from this pressure, a portion of it is going to be generated into steam , and it is this steam, going to the valves and cylinders, that produces the same condition of things, with the engine in back motion, that you have with engine in forward motion working steam.

Water becomes steam at 212° F at atmospheric pressure , now why does not a portion of this water become steam when released from boiler pressure at 363 or 361° temperature? Have any of you noticed that it took more water when your steam was low and your water not the hottest? In this case, the hotter the water, the more of it that will be converted into steam when released, and therefore the less water it will take.

I am like our friend Kaefus, anxious to learn something on this subject.

Deadwood, So. Dak BLACK HILLS

Alex. Cunningham's Breakdown.

Editor The Locomotive Engineer :

I read the conundrum proposed by "Traveling Engineer" in your September issue, and gave it some study, but at last concluded that it was too deep for me, and would patiently wait and see if any one else solved it. Now imagine how mad a fellow will get when he finds that he has been made the victim of a joke. T. E. tells us in the October LOCOMOTIVE ENGINEER that the rod broke and let the piston travel far enough for the rings to spring into the port That is easy enough, but the springs must have been very stiff to keep the steam from blowing the packing out of the port, provided, of course, that the rings were about as wide as the port, if the rings were not near as wide as the port they would not obstruct it, and a few admissions of steam—first on one side and then on the other—would soon reduce that Dunbar packing to atoms. It is barely possible that the head would wedge itself in the cylinder so tight as to resist the pressure of steam.

When a piston lets go of the rod, the thump it would make in striking the cylinder head ought to be of sufficient importance to arouse the curiosity of an engineer of an inquiring turn of mind into examining his right-hand connections. This he could have done by reversing her several times with some steam on, or got the fireman to do so while he felt for the pound. This would have given him a clue to work from, as there is always some perceptible movement to the crosshead with steam on There is nothing like feeling the "pulse," especially when it is so easily done. I will say here, to prevent the possibility of being misunderstood, that it will be necessary to have the engine standing so the steam will be admitted to alternate sides of the piston when feeling the "pulse."

That a locomotive in the condition that this one is represented to be should be pass d on by a lot of shop mechanics as O. K speaks volumes to their discredit; but what caps the climax of thick-headedness is that a man should run three trips with one side wholly disabled, and only complain of "three legs." An engineer who can get over the road as well with the use of one cylinder as two, deserves great credit. This is a saving of 50 per cent.—about 25 per cent. more than the compounders claim, and is well worth investigating before the questionable expediency of compounding.

We now come to the utter impossibility of running an engine on one side only, and make repeated stops and starts without getting stuck on the center, without taking the greatest precaution to prevent it. It will be in order now to say that the road was down grade all the way both ways.

With the reader's permission, I will say that I am not an engineer, or even a fireman, but that I have always looked upon a locomotive with admiration, and take pleasure in reading anything that relates to them ("Modern Locomotive Construction," for instance). I am also acquainted with several engineers who accord me the pleasure of riding with them occasionally, and by this pick up some practical information. I say this that those who are engineers may know that if my conclusions are not well grounded, that this was written by A. FARMER.

Youngstown, Ohio.

How About This? Traveling Engineer Called Upon to Explain.

Editor The Locomotive Engineer.

I read the question and answer of Alex. Cunningham's engine in the October number, allow me the privilege to ask for an explanation.

Taking the construction and size of his eight-wheel engine, we would suppose that he was running a freight train at the time on the Mobile & Ohio Railroad.

When he first observed the defect in the exhaust of his engine, it was natural as an engineer to inquire into the defect

No doubt after examining his first start of his engine and train, he had the luck to have the other side of his engine not on forward or backward dead center

If such would be the case, he would be required to use a pinch bar, or cut loose from his train and run forward a certain distance, and then re-attach to his train to bring the engine in position for starting.

Now the question I wish to bring before his notice is How did he make another trip handling whatever train he would on a railroad, with the working capacity of only one side of his engine, and do the work satisfactorily? This is a misconstruction for railroad men, which should be avoided if possible. HENRY B STOFT.

Philadelphia, Pa.

Traveling Engineer, Please Stand up While the Boys Ask You a Few Questions.

Editor The Locomotive Engineer

I would like to have Traveling Engineer (of Alex Cunningham's puzzle) answer following questions through your valuable paper

1.—Was the M. & O engine that Cunningham run on the puzzle trip an every-day locomotive run by steam?

2.—Was Alex. Cunningham an every-day engineer?

3.—If he was, did he pull a full train, and not have any trouble starting a full train with an engine working on one side, and not know it?

Galesburg, Ill. R L. F

Editor The Locomotive Engineer:

If consistent with space, would like to ask "Traveling Engineer" a few questions He says piston head was found—after second examination—in front end of cylinder. Dunbar packing had dropped—I should have said sprung—into counterbore and port, holding piston head there, shutting off steam from front end of cylinder. According to that, head must have broken off piston rod while engine was making stroke from back dead center to front dead center, or from back end to front end of cylinder. The first question I ask Traveling Engineer is, What prevented the piston head from breaking out, cracking, or at least making a mark on cylinder head when follower bolt heads struck it, as strike it they must, for the piston head to get into counterbore? He says that when machinists took off her right cylinder head she stood on the forward center on that side, and the piston stood close up, apparently all right. I would ask him how a piston can appear all right to a mechanic when it is far enough ahead for packing to spring into counterbore. Another question How came it that Engineer Cunningham ran that locomotive more than a round trip without finding out that she was working but one side, or one engine? If he can answer these questions mechanically, I may ask him more in regard to this breakdown, for I want to learn all about it, as it is a new one on me

Superior, Neb. ROUNDHOUSE MAN

Editor The Locomotive Engineer.

In reading your October number I note the answer by "Traveling Engineer" to his "Three-legged Puzzle" about Alex Cunningham's engine. Calling to mind the original story, I was "stalled" on one or two points in the answer

In the first place I would like to ask At what part of the stroke of an engine, running, would there not be sufficient energy or momentum to carry a broken piston head up against the cylinder head? Of course, if the break occurred after the opening of the exhaust, the steam pressure would be greatly reduced—perhaps reduced to zero. Supposing the break had occurred at that point, which would leave the piston head with but one force behind it—the piston rod; then the lead which would take place before the piston head had reached the end of its stroke would force the head back, and at the next forward stroke it would go through the cylinder head. I am not trying to condemn the question, nor say that it is untrue, but I do say that I cannot see how a piston rod can lose its head without said head showing itself through cylinder head.

And then another thing After the head breaking off and lodging in front end of cylinder the engine only had *one side*. Then Mr. Alex. Cunningham made a trip over the road with one side, did he? He *must* have found out that he only had one side before he took his train out. Strange things they used to do a few years ago. (?)

N. Y. City R. B. READING.

Editor The Locomotive Engineer:

I read about the Cunningham engine. How is that about running an engine *another trip* with only the end of a, say, 3-inch piston rod, to work the right side, as against the, say, 16-inch piston, on the left side? About how much help would this end surface of the piston rod give towards moving the engine, should the left-hand piston be on the center? Is not this Cunningham's engine rather too much at once? H K. B

Kansas City, Mo.

Editor The Locomotive Engineer:

Noting Traveling Engineer's explanation of the alleged Cunningham trouble on the M. & O., will say that in my opinion it goes to show the incompetency of the parties examining the locomotive.

I fail to see how a man could look into a cylinder and not notice that the piston packing had dropped into the counterbore and port, and knowing that trouble was reported did not even measure piston clearance On most locomotives the follower bolt-heads would fetch up against front cylinder head before packing would drop out; have seen exceptions, though.

T. E. says Cunningham moved her to look further and found she went all right, and ran her in

Does he mean that she ran along all square apparently? If so, under the circumstances, would like to have him explain how such a thing were possible—after the so-called machinists examined the locomotive and discovered nothing wrong, she still appeared to take steam at three corners only—to allow her to go out on the road.

Where was the traveling engineer? H.

Boston, Mass.

Editor The Locomotive Engineer:

I should like to ask Traveling Engineer if he has any idea what Alexander Cunningham thought was the matter with his three-legged pet, if, when wanting to pull out of a station, he found that she was standing on either center on the left side In my experience with engines working on one side, I have usually had to start them with a pinch bar when standing on center on the working side.

Saginaw, Mich. FRED TAYLOR.

Editor The Locomotive Engineer:

I have just read with no little amusement the answer to Traveling Engineer's breakdown puzzle, which was published in September number of your paper, and I must say that Mr. Cunningham must certainly be a dandy to run an engine one round trip practically on one side and not find it out.

The Mobile & Ohio must be a peculiar kind of a road—a little down hill both ways (so to speak). I think Mr C was extremely fortunate in not having stopped his engine on the left dead center at any time during the trip, or he might possibly have found use for a pinch bar I would suggest to Traveling Engineer to give us something a little more reasonable the next time Perhaps some of us starters and stoppers here in the wild and woolly West may accidentally stumble onto a correct answer. F F. D.

Colo. Springs, Colo.

From Alex. Cunningham Himself—Hard Times in Dixie.

Editor The Locomotive Engineer.

I see in your September LOCOMOTIVE ENGINEER that some one has been using my name in vain, so I will inform Mr. Traveling Engineer that I am not dead yet, and to enlighten my numerous engineer acquaintances, and keep them from thinking I resemble one of those things used in turning a grindstone. Now, I suppose, Mr. Traveling Engineer gets this question up for instructions, or maybe he is going to start a guessing school; but I think his puzzle is simply ridiculous.

According to his explanation in the October number it is barely possible, but not probable, that I should finish out that trip with numerous stops, and make another round trip with numerous stops and not get her stuck on the center; and what kind of machinists would take off both cylinder heads and not notice the piston head on right side being close against the cylinder head? It had to be clear ahead, so as to stop up the porthole in the cylinder.

I did have a piston to break off while I was running there, close to piston head, but with a different result from what Traveling Engineer explains it The first indication of it was a thump which cracked the front cylinder head; I immediately shut off steam and stopped; I told my fireman to give her steam very lightly, which caused another thump in the left side; I then located the trouble at once and put her on one side, started along and made up my lost time. I am the only Alex. Cunningham that ever ran on the Mobile & Ohio road; I ran there thirteen years.

Right after the war the track was very rough; I had a great many accidents of most all descriptions, and came near getting killed several times; I was once dug out from under an engine; she turned over on me; the company was poor, and I worked for them when they owed me eight months' pay, and when the bondholders took the road and got it up in good condition, and my job got to be worth keeping, then the Assistant General Superintendent, Mr. Cecil Fleming, and Master Mechanic M. T. Carson, discharged me and three or four other engineers simply because we belonged to the B. of L. E.; then all the others belonging to the order were induced to finally withdraw or give up their situations. All this was done without the knowledge of Col. Rives, the General Superintendent. Afterwards, I am told, Cecil Fleming repented of what he had done, and committed suicide, and I am expecting every day to hear of Carson doing something the same. I wish he would, I would erect a monument to his memory—a fine one, too. I will make it out of pulverized stone. Carson's enmity to the B. of L. E. started at Mattoon, Ill. For particulars I will refer any one to my brother, J. M. Cunningham, who is now running on the Canada Southern road, between St. Thomas, Ont., and Buffalo, N. Y.

Pine Bluff, Ark. ALEX. CUNNINGHAM

Those Lubricator Glasses—Testimony of the Jury.

Editor The Locomotive Engineer:

I see in your last issue of THE LOCOMOTIVE ENGINEER a cut of two Nathan cylinder lubricator glasses, sent you by E. G. R., Mt. Savage, Md. He states that the glasses are eaten away at the top on the Nathan lubricator, and not on that of another make. I have often noticed this same thing myself. My idea about the matter is this. The glasses in the "Nathan" are worn or eaten away at the top by the action of the steam coming through the dry pipes of the lubricator and into the tallow pipes running to steam chests. You know the old adage: "A continued dropping will wear out a stone." I think the dry steam continually sweeping around the top of glasses in time wears them away. On the Detroit lubricator the steam does not have the same chance at the glasses, as the top of the glasses are covered with a part of the arm holding the glass, and the oil or tallow, whichever it may be, passes through an automatic safety valve placed directly over center of the glass; this valve is forced open upwards to permit the drop to pass through, and all around the ends of the glass is the water, which seems to have no current, but remains stationary—having no motion it does not wear away the glass. These safety valves close automatically when a sight-feed glass breaks, while in the "Nathan" you have to screw down the valve by hand to prevent the steam escaping.

Camden, N. J. FRED B. ARMSTRONG

Editor The Locomotive Engineer:

My attention has been called to an inquiry on page 167 of your September issue, signed E. G. R., headed "Sight-feed Glass Phenomena," in which information is asked regarding the cause of the wasting away of the upper ends of the sight feed glasses in the Nathan Locomotive Lubricators. E. G. R. also states that "sight-feed glasses" in the Detroit lubricators do not break in this way. In reply to your "Who can explain this trouble?" I should say that the reason of the wasting away of the upper ends of the glasses in question, as shown in the illustration, is found in the construction of the lubricators, which is such that, when steam is shut off from the cylinders at the throttle, and the equalizing pipes are thereby thrown into action, the velocity of the steam through these pipes carries the water of condensation from the condensing chamber over with it, a strong current of steam and water, therefore, impinges upon the tops of the glasses which stand above the rubber gasket, and cuts them away in the same manner as would be done by a "sand blast." It may be argued that the glass is below the line of current; I grant this, but the velocity of the current is such as to cause a strong eddy in this chamber acting in the manner described, as is also done in water gauge glasses in boilers; on the other hand, the Detroit lubricators are so constructed that the steam from the equalizing tubes is prevented from entering the chamber where the glass is, by a small "check valve" placed over it.

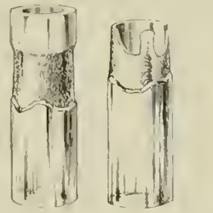
In the Nathan lubricator, the *excess* of water of condensation over that required to feed the drops of oil to cylinder is discharged from the condenser of cup by the equalizing tubes, the Detroit cup returns this surplus water to boiler direct, through the same pipe that supplies the steam to condenser, and take the equalizing pipes from a much higher point. W. ALLEN PENDRY.

Detroit, Mich.

Editor The Locomotive Engineer:

I see in the September number of THE LOCOMOTIVE ENGINEER a communication from E. G. R. in regard to the eating away of the upper end of the Nathan sight-feed glasses, and the cause.

I have had some experience with the Nathan sight-feed lubricator, and always find the glasses as per cut after they have been in use two or three months, and I think it is caused by the action of the steam and water in circulation, as there is always more or less circulation at the top and none at the



bottom. Again, I think the steam plays the most important part, for the reason you will find water glasses eaten away the same at the top, while the bottom will maintain the original size. I send you a sample of water glass taken from a locomotive boiler head, the glass being a little long, the part eaten away being opposite the opening in the cock, while the part extended above is of the original size, showing the action of the steam.

I would like to hear from others on this subject.

Osawatomie, Kan. D. K. BURNS.

Editor The Locomotive Engineer:

We notice in your comments, in the October number, on the "Wear of Sight-feed Glasses," in an article signed by Sam F. Huffman, that your position is not exactly correct. The facts are that the illustration in your September issue shows the glasses worn away *down to the gaskets*. This is easily accounted for by the fact that the glasses extend *up through the gaskets*, at least as far as the illustration shows the damage to have been done.

Detroit, Mich. DETROIT LUBRICATOR CO.

Cast Brake Shoes.

Editor The Locomotive Engineer:

I see in your excellent paper an inquiry as to the first use of cast-iron brake shoes in place of those made of wood. O. E. Stevens, M. M., put on tenders and passenger cars of the Northern R. R. a cast-iron head hung with Rice & Kimball's patent hangers in 1851 or '52, and afterwards changed the pattern to use a shoe bolted on. Before that we used wood and leather.

Lowell, Mass. BEN. F. BUNKLER.

Water-brake Experience.

Editor The Locomotive Engineer:

I got sight of one of your papers the other day, and became so smitten with it that I immediately wrote you for a year's subscription. In the September number, I see J. W. Kaefus, of Aspen Junction, Colo., asks you for pointers on his eccentrics, and wishes to hear from some one on the way his water brake is bothering him. In April, May, June, July and August of 1889, I was watching a 60-ton, ten-wheel, Baldwin engine, with double nozzle, on the Montana Division of the N. P. Ry.; we were building 21 miles of track on a 4 per cent. grade, and a nasty hill it was, too. The engine was equipped with a straight-air driver-brake, with a separate engineer's valve. This was, of course, simply intended to catch the speed with, and help the automatic. We had to use lots of old foreign cars that had no air on them, and the hand-brake attached to only one truck at that, so that it necessitated the use of the water-brake all the time, and it acted just as Mr. Kaefus says his does.

She used to wet the Hobo's every time she brought them down to the boarding train. They made a kick about it, and Mr. Hannibal H. Mayhew, my engineer, told them he could not help it, and was telling me about it one day, and this is the explanation I advanced to him.

The engine does not act that way except when influenced by a system of curves. The level of the valve seat is a trifle higher than the exhaust passage in the saddle, so that when an engine gets into a 12° or 15° curve the valve seat on the outside of the curve will be at an angle of from 15 to 20 degrees above the exhaust passage of the saddle, and the valve seat on the other side will be about level with the exhaust passage of that side. The consequence is that water collects in the high side of the saddle until there is a resistance formed in that branch of the water pipe by the water plus the compression when the flow nearly stops for that side, and that valve and cylinder will be dry. But on the other side the exhaust passage of the saddle has dumped its collected head of water into the exhaust cavity of the valve, and the piston acting as a pump, the vacuum stroke sucks some of the water into the cylinder, while the compression stroke drives a great deal out of the nozzle, and two-thirds of the capacity of the brake pipe is being discharged into this side, to help the cylinder sprinkle the right-of-way, and the engine will continue to act this way away out onto a piece of straight track, caused by the unequal compression pressure on first one cylinder and then the other, thereby causing an excess pressure in one or the other branch of the brake pipe.

Mr. Mayhew thought my suggestion a good one, and went at it to prove the truth or falsity of my ideas. We both found by watching her actions closely that when the heaviest flood of water was in one cylinder, the other one would be perfectly dry, or nearly so, and by the time she had got into the middle of a 15° reverse curve the valves would be trying to tear the reverse lever loose from the quadrant. Mr. Mayhew would also shut off the water when coming out of a curve onto a long straight piece of track, put on his driver-brake, throw the lever ahead, and throw all the water out of the cylinders and nozzles, then hook her back again, release the driver-brake, and turn on the water, and it would work all right till she got almost around the next curve, and then one cylinder would run dry, and she would begin to cut up as bad as ever.

Of course, he only did that as an experiment, but he made up his mind that there was no other remedy for her but to put a pair of cylinder cocks in the exhaust passages of the saddle, which, of course, is naturally the first thing a man will think of. I have seen several of the boys try to work their water brakes on the big hogs running out of Livingston, and Helena, Mont., but they would all squirt water out of the stack. This may not touch Mr. Kaefus' brake, but I have endeavored to give my idea of the cause of his trouble.

Joplin, Mo. GEO. SUART.

On a good many roads out of eastern cities, special club cars are provided, and are paid for by well-to-do business men who want a sofa chair insured, a chance to play chess, or read undisturbed. On the Old Colony road out of Boston, there is an entire club train of special cars that runs down "the wild and rock-bound coast" for some fifty odd miles without a stop. This train is a fast one, and has earned the name of "The Flying Dude," given in derision for the exclusiveness exhibited by its patrons. In addition to the regular fare, the subscribers pay $1,000 a month for the train.

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NEW YORK, NOVEMBER, 1891.

CONTENTS

Business Announcement.

Owing to the demands upon the time of the executive officers of this company, required to meet the steady growth of our other business, as publishers of the *American Machinist*, we have, under date October 5, 1891, disposed of THE LOCOMOTIVE ENGINEER, also heretofore published by us, including all right, title, and interest in same, to Angus Sinclair and John A. Hill, who will fulfill all contracts of whatever nature heretofore made with us relating to the business of THE LOCOMOTIVE ENGINEER. We bespeak for the new proprietors of THE LOCOMOTIVE ENGINEER the favorable consideration of its patrons.

AMERICAN MACHINIST PUBLISHING CO.
New York, Oct. 5, 1891.

A Change.

On the first of October, Angus Sinclair, editor of the *National Car and Locomotive Builder*, and John A. Hill, editor of THE LOCOMOTIVE ENGINEER, formed a partnership and purchased of the *American Machinist* Publishing Co. THE LOCOMOTIVE ENGINEER.

The paper will complete its present volume to January next exactly in its present form. For 1892 the name will be LOCOMOTIVE ENGINEERING, with "a Practical Journal of Railway Motive Power and Rolling Stock" for a sub title. The page will be enlarged to four columns, so as to admit of the use of larger and better engravings, and the number of pages will be increased very much—twenty pages of reading matter anyway—and the price advanced to $2.00 per year.

Mr. Sinclair, who is well known as the author of "Locomotive Engine Running and Management," and as Secretary of the American Railway Master Mechanics Association, will hereafter devote all his time and attention to this paper, while John A. Hill will continue just as he has, only with increased zeal.

The present owners have secured for the next year a number of new and intensely interesting features, and propose making the paper a model of its kind.

The educational features will be kept up and increased, historical matter, current events, and, in fact, everything new that can be of interest to any man employed in the motive power or rolling stock department of an American railroad, will be sought and shown.

Our readers have repeatedly assured us of their complete satisfaction with THE LOCOMOTIVE ENGINEER, many have expressed a wish to see it a weekly, and hundreds have written that it was worth a dollar a number.

Now, we believe that a *good* monthly is far better than a *poor* weekly—the average railroad man can't keep track of a weekly.

We will have room to show everything of interest in the new paper; we are conceited enough to think we can make the best *practical* paper in the field—both of us have earned our bread with the scoop and the throttle—and we propose putting LOCOMOTIVE ENGINEERING on trial for her life. Will you be on the jury?

We have established an office at 912 Temple Court, corner Nassau and Beekman streets, where we will be glad to welcome all our friends.

ANGUS SINCLAIR.
JOHN A. HILL.

Good and Bad Tool Steel.

A short time ago, while standing watching the work going on in a railroad machine shop, the writer was admiring the deep cut taken by the tool in a lathe of a well-known maker, when there was a sudden stoppage of the work, and the machinist took out his tool and went to the grindstone. The cutting point had broken off. In conversation with the machinist, afterwards, we found him full of enthusiasm about the lathe, and the work he could do with it if he could only get the tools to stand. The foreman was a man who believed in making the machine tools work up to their capacity, but his management appeared to result in great hurry and small speed, for more time was lost in sharpening tools than there was extra progress made with the deep cutting and high speed of the machines. The machines were designed to perform the heaviest cutting without distress, and the difficulty was in the character of the tool steel used. The purchasing agent, like many others of his class, considered that he was serving his employers zealously by saving a few cents in the price of tool steel bought, and his action reduced the value of all the good tools in the shop. The loss that resulted to the company in this case from purchasing cheap tool steel impressed us so much, that we investigated the matter in connection with a variety of shops, with the following result: manufacturers that have to meet sharp competition in business rarely purchase anything but the best brands of tool steel. When they purchase from reputable makers, they say that the quality supplied is very uniform in character, and stands the severest work without failure. The first cost of the steel is high, but that does not count beside the loss in reduction of work that results from the employment of inferior tool steel. In some railroad shops the tool steel is satisfactory, and is of the best quality, and the results obtained on machines as good as could be desired; in others, and by far the majority of railroad shops, the tool steel is of inferior quality, and the speed and work of lathes and planers are regulated to suit the durability of the tool. In one large railroad shop noted for the slow-going movement of the machinery, we asked why they did not speed up the machines, and were informed that the cutting tools would not stand it. Where inferior steel is used, we invariably find among the tool dressers, secret and mysterious receipts for making cutting points durable. Most of them are like the remedies of other quacks. An old saying tells that, "Good wine needs no bush." For similar reasons we might say, "Good steel needs no doctoring."

Long vs. Short Eccentric Blades.

A correspondent calls attention, in another column, to the use of very short eccentric blades on some new ten-wheelers for the Lake Shore.

These short blades are used here to avoid a long, curved rod around the forward driving axle, or, what is worse, an intermediate rod around the axle, and hung on links or guides at the rear.

The great trouble with the long, curved rod is its weight and consequent excessive friction on eccentric at high speed; then, its curve makes it, even when pretty heavy, a springy affair under heavy work. With it the rocker is carried close up to the steam chest, and, to avoid excessive wear of packing, a knuckle at the rear, and a horn on yoke, and an extension on the front of chest are needed; this objection also obtains where the intermediate rod is used.

The intermediate arm has an added objection, in its extra joints to get lost motion, and their proneness to break down.

The single objection to the short radius is the excessive lead when hooked up, but this, it seems, has never given any trouble except on paper, and in the imagination.

At high piston speed, more lead is necessary for quiet running, and we have yet to hear of trouble from this cause on a road using short radius links.

The Denver & Rio Grande have something like 200 narrow gauge consolidation locomotives, with 36-inch wheels, having links with a radius of less than 30 inches (if we remember rightly 27 inches), these engines have run with a tenth of an inch lead, at full stroke, for years with satisfaction. They are freight engines, but very small wheels, and the old speed recorder sheets of the road show miles upon miles made with these engines at and above 30 miles per hour, this is high piston speed.

The best ten-wheelers on the Santa Fe have short eccentric rods and long valve stems.

This plan makes the valve gear as simple as the simplest; the long valve rod can have a guide near its center to prevent trembling, and the vibration at the stuffing-box is practically *nil*.

With the long eccentric blades the friction of the eccentric, multiplied by the leverage of the long blade, has too much chance to make the reverse lever dance, as well as the man who handles it.

The Big Four are in the market for thirty engines and forty passenger cars.

Rapid Transit Plans for New York.

The commissioners appointed to propose a plan for rapid transit for the city of New York have made their report, and recommend what is known as the Worthen plan. This provides a four-track road under the streets, Broadway, the Boulevard, and other streets. The lower end will be a loop at the Battery, thus preventing the switching of trains There are also other cross-town and diverging lines The road will run near the surface, and far up town come out upon a viaduct, and cross the Harlem River on a drawbridge The two outside tracks will be used for local business, and the two inside tracks for express trains, depots to be located a quarter of a mile apart. The length of the line will be something over twelve miles The motive power will probably be electricity, but the commissioners only demand that it shall be capable of pulling express trains at the rate of forty miles per hour, and operate without combustion. It is estimated that this great undertaking can be completed in two years, but it is probable that it will take at least twice that long.

Pulaski Leeds, Superintendent of Motive Power, of the Louisville & Nashville road, is making a stir among the men about posting up a little better. He has adopted a progressive plan of examination and gotten the firemen of the road really interested in getting information. The company bought a quantity of Sinclair's "Locomotive Running and Management," and Hill's "Progressive Examination of Locomotive Engineers and Firemen," and furnish them to the men at wholesale rates. Mr Leeds has arranged to mount one of their old ten-wheelers on rollers, and make provisions for crippling her easily, and will take men ready for final examination to her and make all examples practical. The engine will be in steam and in same condition as for the road. Mr. Leeds will have a lot of well-posted men the first thing he knows.

We hope that the enlarging of this paper to almost three times its former size, and the addition of Augus Sinclair's work on its pages will entirely satisfy those who have written us so many letters asking for a weekly or semi monthly. The time for a weekly in this field has not arrived—we doubt if one is needed. We will promise that this paper shall contain all that is new and interesting to men in the motive power and rolling stock departments of American railroads, and trust that they will appreciate and support the effort—it's time we were all posted a little better

Non-combustible material for locomotive boiler covering has lately been found valuable in keeping heat out An engine-house was burned a few months ago, belonging to a road that were using asbestos boiler lagging. Two engines with that covering happened to go through the fire, and they came out with their boilers unscorched. The boilers of the engines that had a wooden covering required extensive repairs before being used again

The present Erie management are progressive. It is now said that they will abandon a tunnel scheme to shorten the line, and spend the money in putting block signals on the entire line. This is good business sense, and, if done, the line will reap the reward always accorded to the *first* with the *best*. Safety on our roads can only be said to be honestly attempted where there are automatic brakes and block signals.

John Wiley & Sons, of this city, have in preparation "Modern Locomotive Construction," by J. G. A. Meyer, a new and valuable addition to the literature of the locomotive. It will be very large and elaborate, several hundred engravings, and be worth probably $10.

If your subscription laps over into 1892, and you would like the complete volume instead, you can have back numbers to fill out your year. The paper for 1892 will have a larger page, and more of them.

Georgia has passed a law to prevent railroads from working trainmen more than twelve hours consecutively.

Book Reviews.

ELECTRICITY FOR ENGINEERS. By Charles Desmond. Frederick Keppy, publisher, Bridgeport, Conn Price, $2.50

The first part of this book has been out for a year or so, and has met with a very favorable reception by the engineering profession and the endorsement of the electrical press The new part treats of the more recent developments in the electrical field, and brings the work up to date. The intention of the author seems to have been to take intelligent engineers and mechanics, who know little or nothing about electricity, and using language with which they are familiar, explain everything about electricity about which they want to know in order to handle ordinary installations for lighting or power likely to be entrusted to them The book will give any mechanic a clear idea of the principles of any electrical device how to use it intelligently and care for it It is a good book.

ASKED & ANSWERED.

(63) G E R, Westtown, Pa., asks :

Is the so-called Richmond & Danville cast-iron stack narrow in the middle and flaring at both ends? *A* —The R. & D. stack is bell-shaped near the saddle, and smallest about a foot above base.

(64) J. C. D. Carlin, Nev., writes :

What breaking power has a jet of water one-quarter inch in diameter turned into the cylinders of an engine when engine is running reversed I claim the only effect it has is that it keeps the valves and pistons moist, and all parts cool. Am I correct? *A* —You are quite correct.

(65) T. J. H., San Bernardino, Cal., asks :

Why will an injector not work when an engine is reversed running down hill without water brake being applied, but as soon as water is turned into cylinders the injector will work? *A* —The water-brake can have no influence on the action of the injector. Something else prevented its working.

(66) ——, Oxford, Pa., asks .

What should I do if I break the main pin on a mogul engine having solid-ended rods? *A* —Take down broken side completely, and take side rod off the other side; disconnect your valve stem; push the valve *ahead* and the piston *ahead*, if the cylinder is all right; if not, cover the ports with the valve. Leave your train and run in.

(67) E C., Albany, Ga , asks :

1. How would you get at the length of an eccentric blade if you broke an eccentric strap and had a new strap sent you from shops to be put on on the road? *A.*—Measure other eccentric blades, and make the new one same length 2 If you was to slip an eccentric blade, how is best and quickest way to set it? Can it be set by marks on valve stem same as setting an eccentric? *A* —Yes

(68) I. E. B , Dalton, Ga., asks .

What is the best way to fix a broken driving-box to get engine to shops, say box is broke parallel or vertical? *A* —Anything can be done to relieve the load carried by the box to prevent cutting of journal where box is broken through bearing. A box broken horizontally below the bearing will usually run all right by blocking above it and blocking equalizer down Much depends on the design of engine and the shape of the break

(69) J. S. M., Danville, Ill., writes :

I wish you would advise me how or with what I can pack an iron throttle stem so that it will not leak inside of a week anyway and also handle easily *A* —Much depends on the opening in the back of stuffing-box Winding a rubber gasket with asbestos wick for the back ring, and using rubber gaskets ahead of it, is as good common material as we know of Jenkins packing disks or Selden's rubber-cored packing is highly spoken of for this kind of work

(70) K G , Selma, Ala., asks .

1. Does a blow occur just after crosshead leaves extreme center, or just before leaving dead center? *A.*—Usually at and after leaving the center 2 Suppose you were running a mogul engine and you broke the equalizer of pony truck of engine, what would you do to get engine to shops? *A* —Block so as to keep long equalizer from rubbing the pony truck axle, and between the front cross-equalizer and the boiler to keep spring system level. Run slow over bad frogs, etc

(71) G E. R., Westtown, Pa., writes :

Forney's Catechism, page 522, in answer to Question 668 says. "All cocks in the train line air pipe should be opened, excepting that of the cock at the rear of the train, which should be closed by turning its handle so as to stand parallel with the train pipe." Is this not incorrect? I think the cock handle should be turned at right angles to train pipe *A.*—On old-style brakes the handle stands parallel with pipe when shut off; on the latest brakes the handle stands at right angles when shut off, and paralleled when open.

(72) J W , Kaukauna, Wis., writes.

Will you kindly decide the following argument for two readers of your interesting and valuable paper? Will a locomotive boiler steam as well or more economically with three or four gauges of water than she will with one or two gauges? My friend says she will not I think she will, for the reason that the feed water will not cool the larger amount as easily as it would the smaller. *A.*—The boiler with the most water will steam the best, for several reasons, one of which is that there is more water to carry latent heat, the cold feed has less effect, and the feed can be safely lessened to admit of using more steam on hard pulls

A "Holy Terror" Steamer in the Hands of Jim Skeevers.

Skinny Skeevers, him of the object lessons, ran Mike Monnihan's engine for a long time, while Mike went to visit the "ould sod," and Skinny's engine got a new fire box and a coat of varnish.

The first time Skinny oiled around, he hollowed up to Patsy Killigen, the fireman, to put on the injector, and cool her off, so he could see the oil holes; she was howling so it gave him the blind staggers.

"How does she steam, Patsy?" asked Skeevers, as they started out.

"She's a 'Holy Terror' for wind," said Pat, proudly. "She's always crazy wid it."

Skeevers was somewhat annoyed at the constant howl of the pop, but it did little good to speak to Pat—Pat fired by the pop, and a "Holy Terror" was his ideal.

Skeevers thought he'd try an object lesson.

"What size nozzle has she got?" asked Skeevers

"Oh! Lord, you ain't a goin' to go monkeying with her nozzles are ye, Skeevers? They are two-and-a-half or three inch, now "

"She burns too much coal, and howls too much."

"There hain't another steamer like her on the road," moaned Patsy. "Why, you can never shut off her throttle, but up goes her white tail—steam! Why, she's the darlin' of 'em all, Skeevers "

Skeevers got a smaller scoop, but Patsy plied it industriously, and the "96" still held the first prize as a "Holy Terror" for steam.

Skeevers bribed the coal shovelers to put on a tank load of lumps, none to weigh less than two hundred, but Pat paralyzed them, and reported the coal shovelers beside.

Skeevers thought of putting a flat car between the engine and tender, but gave the idea up as impracticable.

Patsy would put in a fire within two minutes of a regular stop, and be happy when the black smoke rolled, and the white feather stood proudly up forty eight feet above the howling pops of the "Holy Terror" Skeevers was in despair.

"Pat, did you ever stop to think that you were shoveling a lot of coal through that pop for nothing?" he asked.

"I don't mind the work, Skeevers," said he ' Don't mind it a bit, it makes the other lads green wid envy to see how she do steam."

"But it wastes coal."

"Bless ye, me boy, the company own their own mines, and it's proud they ort to be to have such steamers."

Skeevers couldn't get Patsy mad, and could awaken no other feeling in his heart but worshipful admiration of the prolific steam production of the "Holy Terror."

The run was a light passenger one, and after some scheming Skeevers got Pat and the "Holy Terror" on heavy freight run for a week. Skeevers managed to use all the steam that was made on the road, but Pat insisted on a pop solo at every stop.

Skeevers hated to disturb the front end adjustment of another man's engine; he finally determined to enlarge the nozzles, but concluded that this might give them trouble on the road, and besides that, Skeevers didn't believe in patching an engine to repair a man, any more than he believed in feeding a fireman Lord's compound to keep scale out of a boiler.

But right here the road got a new master mechanic, and the very first month he put up a bulletin of the amount of coal burned on each engine, and the "Holy Terror" was away down in the middle of the passenger engine list.

Pat was pretty mad about it, and said, if they would figure on who made the most miles or the most hours with the steam pressure at or above 140, he and the "Holy Terror" would take first money.

The next month he stole a few lumps of coal, gave the shovelers cigars for big measures, etc., but the bulletin appeared again with the Holy Terror advanced but one point.

Then came a bulletin notice that firemen would be promoted on merit, especial preference given for a coal record.

Pat had a nightmare that night when he thought of the "Holy Terror" and himself in eighth place, and Jim Bean, who was hired four months after he was, leading the list for coal and promotion.

That evening after they got to going up the hill, and the pop sat down to rest a minute, Skeevers called Pat over, and, in a friendly way, told him that the "old man" had said he should have to promote three or four men in the fall, and that he was afraid that Pat would lose his chance and see a lot of younger fellows pass him, if he didn't mind Skeevers suggested that the main trouble was with the "Holy Terror," and not Pat, and proposed that they prove it to the "old man" by having Pat transferred for one month to the "94" that was then leading the coal burners

Pat agreed to this if Skeevers would arrange it—he didn't know that Skeevers had arranged it.

When the next bulletin came out, the Holy Terror was at the head, and the "94" was fifth—Pat was improving some

Pat was glad to get back with Skeevers and the "Holy Terror"—said old man Martin on the "94" kept "picking at him" about opening the door and monkeying with the dampers.

Jimmy Bean was set to running switch engine in a week or two and Patsy's heart was broken

"Skeevers," said he, "I'm disgraced. Whatever the devil is the matter with the '96,' or—or—me?"

"The '96' is, without a doubt, the best engine on the road, Patsy," said Skeevers, "and honestly I think you are the best fireman, or rather would be the best, except that you haven't figured out plainly just what you are trying to do—you don't realize what you burn the coal for"

"To make steam, of course," said Patsy

"What do you want of the steam?"

"To pull the cars av course?"

"Where do you put it for that?"

"Into the cylinders, surely"

"Suppose you have more than you want?"

"Out of the pop she goes—can't hurt nothin'."

"But the coal pile?"

"Coal pile?"

"Yes, don't it take as much coal to make steam to blow through the pops as it does to make the same amount of steam to be used in the cylinders?"

"But there don't much go out of the pops."

"That's where your mistake has been made, Patsy. Pop Martin told me this morning that if he had all the steam that the '94' made and wasted at the pops while you were on her, he could make four round trips without coal or water."

Pat put in a fire and gave a big lump a few vigorous whacks with his coal pick, and then came back

"I've a notion to quit, Skeevers," said he.

"You fire this engine the best you know how for another month, take my advice, and if she don't head the list, I'll quit," said Skeevers.

"You want to remember that in making steam to throw away, you not only waste fuel to make it, but you waste water. Water is cheap, but it takes coal to haul it around, and the '96' takes more water than the other engines do, and hauls many tons of it a month for nothing; then we have to stop for water oftener, and that takes coal—takes coal to stop and coal to start."

"Coal to stop, how d'ye make that out?"

"There you are again, Pat, you see you haven't figured on your business or followed cause and effect up very much. Don't you know that it takes just as much power to stop a train, leaving out friction, as it does to start it?

"When you set the brake it commences to use up and loose 'stored energy' that has been put into the train by the coal, through the medium of the cylinders.

"Then your brake will use more steam to get its pressure back again, and the '96' will get rid of more coal to get the train back into motion, and use more to haul the extra water. It all counts, Pat, because we do this all day, every day in the month, if it was only once it wouldn't amount to much Think about your work, and figure on how *little* you can do in the way of coal shoveling to get this train over the road, and I will bet on the result"

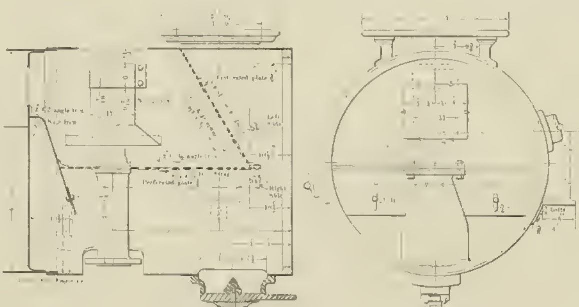
Last Thursday the new bulletin was put up, the "Holy Terror" stood at the head, and Patsy Killigen hummed "Comrades" as he was polishing the hand rail in the roundhouse, when the "old man" came along, touched Pat's leg with his umbrella, and said.

"Come into the office after dinner—I want to talk with you."

The gross earnings of the Westinghouse Air-brake Co. for the year ending Sept. 1, 1891, were \$5,004,179 26, the expenses being \$3,308,383 28, leaving the comfortable little sum of \$1,695,795.98 for net earnings The air brake has saved millions of dollars for the railroads, thousands of lives for the employes, and made our modern railroad system possible. We wish the prosperity of the air-brake company was ten times as satisfactory as it is.

Front End Arrangement of Wilson's Model Eight-Wheeler.

By request of several readers we publish herewith the front end arrangement of the new engines of the C., R I & P. road. The arrangement is a modification following pretty closely the Barnes extension as used on the Wabash, U P, and other lines of roads in the West.



The principal features are the short petticoat pipe adjustable from the outside, the use of perforated plates in lieu of netting, and the arrangement of the sheet in such a way as to present a very large area of opening for the hot gases and smoke Sizes of all parts being given on the engravings, no detailed description is necessary

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Making Lock Washers.

Railroad men are becoming familiar with a peculiar form of open washer which acts as a most efficient nut lock, made by the National Lock Washer Company, Newark, N J. The washer is a circle of a spiral spring, and has one side projecting beyond the other, which is closed by the turning of the nut, and always keeps the amount of pressure on the nut, due to the spring of the spiral. There is a thin rim round the neck of the washer, which impinges against the thread of the nut, holding the latter so firm that no amount of vibration will loosen it. There are several features about this washer which act to hold the nut in place The spring tension tends to hold the nut secure, there is a sharp lip on the cut in the washer which presses into the metal of the nut, holding it tight, and the pin already mentioned makes the thread cling to the bolt. With all these provisions provided against the loosening of the nut, it is not surprising that the National Washer is making headway for railroad rolling stock where the constant vibration shakes off so many nuts held in the ordinary way. We know of nothing that would be more likely to keep nuts on running gear from being worked off. These washers are used very extensively for track joints

Another form of washer made by the same company, and adapted principally for light woodwork, has two small projecting fins that catch the thread. This washer is not cut open, the spring being obtained by making the washer convex towards the outside.

The manufacture of these washers is an interesting operation, and is a good illustration of the enormous increase of production obtained by special machinery Rods for making the washer are specially rolled of spring steel, with the fin spoken of on one edge. A rod of this kind is wound round a mandrel in a special lathe about as fast as a woman winds a ball of yarn. When the whole rod is twisted round the mandrel, it forms a long spiral spring. Six or eight rows of these spirals are then firmly secured on a table, like the table of a small planing machine. This is moved under revolving saws which cut an opening along the top of each spiral When this cut is completed the whole spiral falls apart, and there is a washer for every turn the rod made round the mandrel.

The washers are then taken to furnaces, and heated to a cherry red, and then dropped into an oil vat for hardening. After getting this oily dip, the washers are taken to a revolving cylinder and rattled in a cleaning mixture till they are bright and shining. This is necessary to show the color while the temper is being drawn. Next operation is drawing the temper, which is done by revolving them at a low heat over the furnace till the color shows that the proper temperature has been reached. After quenching they are ready for use The percentage of carbon in each batch of rods is ascertained by analysis, and the color for drawing the temperature is regulated accordingly. Each lot of washers is thoroughly tested by closing a certain number in a machine before any of them are shipped.

The length of a nautical mile or knot, as given last month, was wrong; it is given by Bessel as 6,086.44 feet The printer that set up the big number had been seasick, and put in the distance from memory.

Wanted a Little Lay-off.

Uncle Lorenzo J. Patton has been running a locomotive pretty close to half a century, and can be found to-day switching in the Providence yard He pulled one train, the fast freight, for more than forty years, on the old Boston & Providence.

A couple of years ago the Old Colony leased the road and made some changes in the men.

They gave the fast freight to an *older man* than Patton, and otherwise disturbed his routine life.

Uncle Lorenzo went into the office to make a kick, and a dapper young Old Colony clerk stepped up and asked what he could do for him.

"I guess I'll lay off," says Patton, "I don't exactly like the new management of us old Boston & Providence men, and I guess I'll take a little lay-off *till the Old Colony lease runs out*."

The lease was for 99 years.

An exchange says that thirteen engineers, firemen and brakemen on the Cincinnati, Wabash & Michigan were discharged for smuggling beer into the cabs and cabooses, and drinking it while on duty. Good enough, only be sure your men are guilty.

If you are in any way anxious to preserve bound volumes of THE LOCOMOTIVE ENGINEER send in your orders now, as when this stock is gone there will be no more—we can supply a few of each year 1888-'89-'90 and '91.

At the N. Y. Railroad Club.

At the first fall meeting of the New York Railroad Club an informal discussion on flue setting and flue repairs bad. Mr. West, of the Ontario & Western, stated briefly the practice on his road and the difficulties encountered. He uses copper ferrules from $\frac{1}{16}$ in. to nearly $\frac{1}{8}$ in., according to the size of the hole. He aims to reduce a 2-in flue about $\frac{1}{32}$ or $\frac{1}{16}$ in., and has a good deal of trouble with leaky flues in the fire-box. At the smoke box end he has no trouble He asked whether other roads find that reducing or swedging the flues is good practice. Mr Blackall, of the D. & H., suggested that the trouble might be with the engineers, which Mr. West did not doubt, but still thought that that did not explain the whole difficulty

Mr. W H. Lewis, of the D., L. & W, has had a good deal of trouble with semi-steel tubes, but not with iron. He uses copper ferrules, but does not swedge the tubes; they are drawn down with a taper mandrel, driving the ferrule in around the tubes. Mr. Kells, of the Erie, sets the ferrule in the tube sheet first, and Mr. Stinnard had followed the same practice, setting the thimble and expanding the flue through the thimble, leaving about $\frac{1}{16}$ in. outside the sheet. Mr. Lewis uses a No 11 flue, that is, 11 wire gauge, and expands it with a Dudgeon tube expander, run by Stow's flexible shaft. The flues are beaded at the back end, but not in front He finds the life of a semi-steel tube about ten months, and has a good deal of trouble with them. Mr Lewis further suggested that if a tube is a little loose it is very easy to put a hand tool in and tighten it, but Mr West suggested that if that was done half a dozen times there was no flue left. Mr. Lewis controls this by a gauge.

Mr. West has three consolidations built by the New York Locomotive Works, in which the flues cannot be kept tight three months, while with some mogul engines from the same works they have very little trouble. He asked whether any one present had tried flues set in the sheet without a copper ferrule. Mr. Stinnard had tried it a good many years ago on the Erie, and gave it up.

Mr. West said that he had watched the matter carefully and was convinced that it was not the fault of the men, nor was there any trouble with the water. He uses a very good quality of bituminous coal. It was suggested that perhaps his men ran with the door open. This, however, Mr. West denied. He had tried using a layer of fire-brick over the forward part of the grate to prevent cold air coming in there, but got no benefit from this. Mr Lewis was inclined to think that there must be cold air coming in somewhere; either the fire is carried too shallow or the door is left open.

The president called for further suggestions for subjects for discussion at future meetings. Mr Lewis suggested methods of handling coal for locomotives, that is, the best method of getting it from the track onto the engine. Mr. Blackall suggested the care of air-brakes as another topic Mr. Andress was requested to prepare a paper on the qualities and uses of paints.

Mr. Besler in the Soup.

A party of Chicago, Burlington & Quincy officials were out on a tour of inspection mixed with pleasure in the general manager's car, and a fine muscallonge, which one of the party had captured, was to be the leading attraction of the dinner The cook devoted special attention to making the fish a triumph of his culinary art, and the most appetizing sauce known to cooks was prepared to give the muscallonge a good send-off When dinner was called, General Superintendent Besler sat down and continued the story he was telling The waiter carried in a dish and set it down beside Mr Besler, who took up a spoon and began to eat without letting the act interrupt his talk Presently Mr. Harris rang for the waiter, and said, "Why don't you bring the soup for the rest of us?"

"Why, Mass'r Harris," said the waiter, "dar's no soup to-day."

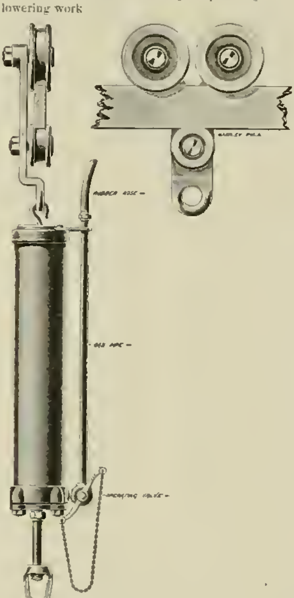
"No soup? Why, Mr Besler is eating soup"

The startled darky gazed at Mr. Besler, and when he could find breath, exclaimed, "Fo' de Laud sake if Mr Besler has not eat all de fish sauce!"

The Mexican Central Railroad has ordered five double-ended locomotives of the Johnstone compound type, to be used on mountain service. Mr. John Player, superintendent of motive power of the Atchison, Topeka & Santa Fe, who accompanied one of the Johnstone compounds over his road lately, speaks very favorably about the performance of the engine. It was found that the provision for working the engine simple at the will of the engineer was sometimes the means of getting the engine over the summit of a grade when the less cylinder power of compound working would have led to stalling. The direct steam is admitted to the big cylinders at reduced pressure, but with sufficient tension to materially increase the power. This is practicable when used merely to make a difficult start, or to prevent stalling, although the boiler would not have capacity to provide steam direct to the big cylinders all the time.

Hall's Pneumatic Hoist.

The hoisting device shown in our engraving is being used with great success over lathes, planers, wheel-boring mills etc., for quickly lifting and lowering work



This device has an improved operating valve that makes its action positive, and its speed entirely in the hands of operator

These hoists are preferably handled with compressed air, but any fluid present may be used.

Their usefulness is not limited to lifting, but they are worth half a dozen "hands" in helping move machinery or other heavy objects, and can be used in any position.

Their advantage over chain hoists is their speed, no manual labor required, and the additional amount of work a tool can do when quickly served.

The sizes and capacities are as follows (eighty pounds of air being used):

3" diameter	450 lbs.	6 diameter	1,800 lbs.
4 "	800 "	8 "	3,200 "

These handy little lifters are made by the well-known tool makers, Pedrick & Ayer, Philadelphia, Pa.

What men can save in oil and fuel is shown in the improvements made when oil companies oil a road by contract. The Galena Oil Works have brought the car service of the U. P. up from 18 to 50 cents for a hundred miles

The Crescent Steel Co. send out a little circular of advice occasionally that is good; here is one of them: "Some tools do not need to be made of as good steel as others, but those which are in constant daily use, planing, turning, chipping or working metals, ought to be made of the best steel you can get. A certain amount of time and labor are expended in making a tool of any kind, and if this is put on good steel, it is saved many times over in the quality and quantity of work done. The difference in value between the best and an ordinary steel, in an average machine shop tool, would be from ten to fifteen cents. The better steel does more work, requires less frequent sharpening, and stands more re-working without injury, so that at a much higher first cost per pound it is actually the cheapest to use, and you buy fewer dollars worth in the course of the year."

At the conductors' fair, at New Haven, Conn., last month, there was on exhibition one of the old time baggage boxes, used on what is now the New York, New Haven & Hartford road, in 1839 These were strongly framed boxes about six feet high, five wide, and perhaps seven long. They were mounted on wheels about a foot in diameter and were provided with a handle at one end. These were loaded with baggage and mail, and several of them run upon a flat car hauled in all passenger trains for this purpose. When the old, hook-motion flat-boat, with a graveyard fence around the boiler head, where the cab is now, came into town with her train, the agent pulled the truck-mounted band box, billed for his town, off the flat, and ran another on, and the train sailed away without the aid of the modern baggage smasher—he was invented later

The friends who have written us, expressing their good feeling, and offering their congratulations at our acquisition of the leading mechanical paper in the railroad field, have been many. We take this opportunity of thanking them, one and all, and promising to do our best the coming year. Watch the paper.

The standard torch of the Delaware & Hudson Canal Co. is a casting that can be made for less than ten cents. The top is joined to the body by a connection that is like an air-hose coupling. Spurs are cast on the torch that keep it from lying flat and setting fire to the floor or platform.

Engineer Robert D. Morton, an engineer on the Richmond & Danville, died of hydrophobia on Oct. 24th. He was bitten by a mad dog on Aug. 5th, and received treatment at the Pasteur Institute in this city, but without avail.

Our friends who advertise have been so enthusiastic about our new combination, that we have been obliged to add four new pages to the paper this month, with prospects of more for the month following

Mr William Hassman, formerly division master mechanic of the Chesapeake & Ohio at Huntington, W. Va., has been appointed superintendent of motive power of the Newport News & Mississippi Valley

Master Mechanic Campbell, of the Lehigh Valley, is having a Pedrick & Ayer tire heater built that will be mounted on a car, so as to be taken from one place to another, where tire work is to be done.

Mr. A F Stewart has been appointed master mechanic of the Cincinnati & Huntington divisions of the Chesapeake & Ohio, Wm. Hasman having resigned, to accept a better position.

The Boston & Albany are having twenty-seven engines built at the Rhode Island works. They will be 18x26 freight engines, with a ten-inch port and short valve travel.

The Burton Car Co. have ordered 500 new cars, divided between the Michigan Car Co. and the Lacona Car Co. To use automatic couplers and N. Y air-brake.

The Schenectady Locomotive Works are building fifty new engines for the New York Central. Several of them will be compounded.

With the Fastest Regular Train.

On October 26 the New York Central Railroad Company began running daily what they call the Empire State express, which is the fastest regular passenger train in the world. The running time between New York and Buffalo, a distance of 439½ miles, is 8 hours and 40 minutes, calling for an average speed of 52½ miles per hour. When the first train making this run started out, a large company of newspaper men and others were on board, and intense interest was manifested in the performance. The train consisted of five cars, weighing in all 178 tons, a phenomenally heavy train for fast speed. Three locomotives were used for the different divisions. From New York to Albany the work was done by engine 870, with Mr. Archie Buchanan at the throttle. This is an exceptionally heavy eight-wheel engine, with cylinders 19x24 inches, and driving wheels 6 feet 6 inches diameter. The run of 143 miles over this division was made without a stop, and the engine seemed to have no difficulty in making the schedule time. In fact, the engineer got ahead of his schedule several times, and had to kill time to fall into it again. The road from New York to Albany is very crooked, and speed had to be reduced frequently for curves, but the engine seemed to have no difficulty in forcing the train quickly into a mile a minute gait. The average running time between New York and Albany was 52 miles an hour.

At Albany, engine 876, with Mr T. Dormody at the throttle, took hold of the train. This engine is of the same cylinder and boiler capacity as the 870, but the driving wheels are only five feet ten inches in diameter. The smaller wheel gives an engine an advantage in starting a heavy train away from a station, but when a speed over fifty miles an hour is attempted the high piston speed necessary increases the back pressure in the cylinders so much that loss of power is soon apparent. In this run the superiority of the big wheel engine was apparent to every one on the train. Dormody had a hard struggle to get the train over the division from Albany to Syracuse, at an approach to schedule time. He had a tank loaded with slack coal of the smallest quality Inferior fuel falls short of its purpose when used to supply the heat for a locomotive fire-box that has to provide the demands of 19-inch cylinders, for more than eleven hundred charges per minute "Tom," in spite of all the efforts of energy and skill lost time all the way, and arrived at Syracuse close on nine minutes late, his running time having been 48 8 miles an hour.

Some of the best runs made on the New York Central system have been performed by engines having Mr Charles Hogan at the throttle. When the news gatherers, and other interested parties on this train heard that engine 862, with Hogan as engineer, was going to pull the train from Syracuse to Buffalo, they exclaimed, with one accord, "Now, we will gain the time lost." "Charlie" made a plucky effort to satisfy some of those who were betting on him, but making up 9 minutes in 150 miles was not in it, when a running speed of 60 miles an hour, after subtracting for delays, had to be maintained to hold to the schedule. He made an average speed of 55.2 miles an hour, and took the train to its distination three minutes late. In doing this he covered one mile in 51¼ seconds, and several times 53 seconds was recorded for a mile. The running of this train from Syracuse to Buffalo was an unparalleled feat in locomotive engineering. A train of this weight was never before run at the velocity maintained. The time throughout the whole run was kept by Mr. A. G Leonard, secretary to Vice president Webb, and by Mr. Angus Sinclair, of this paper. The locomotives that did the work were built at the Schenectady Locomotive Works after dimensions supplied by Mr. William Buchanan, superintendent of motive power of the New York Central.

Many disputes are indulged in between railroad officers and shippers about overloaded and improperly loaded cars. Master Mechanic Turner, of the Western New York & Pennsylvania, saves himself lots of trouble, and fortifies his arguments, by photographing every car complained of as over, or improperly loaded.

At the recent conductors' fair held at New Haven, Conn., the Hall Signal Company, of this city, had a very handsome exhibit of their automatic block signal system and other signaling devices. They had a complete double track road equipped with automatic electric signals, crossing alarms, etc., all built on a scale of one inch to the foot. They showed this plant in actual operation, and, it is needless to add, always had an audience. This company have recently secured control of the Bezer lock and block system and the Bezer & Burley interlocking machine, a device that seems to have decided advantages over any other machine in use. The latest auto-manual block signal of this company seems to be the best that human ingenuity can devise for the protection of trains.

Reports have been received by the Bureau of the American Republics to the effect that the experiment of using petroleum for fuel on the Oroya Railway in Peru has been entirely successful. The trials were made at an altitude of 5,800 feet aboue the sea level, with the two locomotives from the Rogers Works at Paterson, N J. The oil used was a residuum oil differing from crude petroleum In the trials the average consumption of oil was 38.55 pounds per mile, while with coal it was 79.30 pounds. The reports state that the Oroya road has decided, owing to the experiments, to use oil fuel on all its locomotives. Coal is very expensive down there, and in some districts oil is plentiful.

"Condensed Suggestions for Steel Workers" is the title of a neat little thirty-page book issued by the Crescent Steel Co., of Pittsburgh, Pa. This little work is not an advertisement, except that it is issued by a steel-making concern; they do not mention their brand of steel in the book There are six short chapters full of valuable information to any mechanic who has to forge, dress, grind or use steel tools. Annealing, Heating to Forge, Heating, Temper and Furnaces are subjects treated. This little book would be a valuable addition to any mechanic's library It is sent free by the above company. Send for it.

As shown by the last annual report of the directors, the growth in passenger business on the New York, New Haven & Hartford Railroad in the past five years has been phenomenal. In 1886 the road carried 8,267,310 passengers, at an average fare of $1.02; during the fiscal year ending June 30, 1891, the road carried 14,030,868 passengers, at an average fare of $1 92. The train mileage in 1886 was 4,973,243 miles, in 1891, 7,805,078.

The two orders of railway conductors have been amalgamated, as have the two branches of Railway Telegraphers "In unity there is strength," is a maxim true of railroad orders as well as other things The day will come when the railroads of this country will be a unit in policy and management, and the employes will be organized on the same plan; in fact, we expect to see them set the example of unity rather than follow one.

The new order of conductors recently founded at New Haven, Conn., have as their corner-stone a law that they will not, as an order, or as individuals, engage in any strike or other labor agitation. The men on the road who believe in taking care of their interests, even if they have to fight for them, have named the members of the new brotherhood, "The Angels."

Roadmaster James R. Smith, who has charge of the track of the Pennsylvania between Newark and Deans, has just won, for the eleventh time, the prize of $100 offered yearly by the management for the best kept division on the system. Mr. Smith is an old locomotive engineer, and always divides the premium money between his section foremen.

On Oct. 20th a consolidation engine just out of shop exploded her boiler at Tucker's Watchbox, Pa., killing four men. An investigation should be made in such cases, with a view to remedying the cause of such disasters. Low water has come to be regarded in the same light as the insanity dodge—thin.

The Wells & French Car Works have taken contracts for building 500 box cars for the C., B. & Q., 500 box and 500 flats for the Lake Shore & Michigan Southern, and 300 furniture, 200 stock and 200 box cars for the C., R. I. & P. road.

The Chicago, St. Paul & Kansas City Road have added ten more engines to the order of 15 now being turned out of the Cooke works.

The New York Central are asking bids on sixty passenger cars and have ordered fifty new locomotives from Schenectady.

The Lake Shore have divided an order of fifty passenger cars between the Lacona, Bradley & Smith and Billmeyer & Small.

The Grand Trunk has notified the men whose salaries were cut some time since that the old rates will be restored.

The N Y., N H. & H. have ordered two large Forney engines and are contemplating the building of ten others.

The Old Colony Railroad has placed an order with the Wason Manufacturing Co. for 34 passenger cars.

Specifications are out for ten new engines for the Central Railroad, of New Jersey.

John Alexander has promised to tell the boys a story in the January issue.

The Boston & Maine are in the market for 500 freight cars.

The Manhattan Elevated have bids out for twenty new engines.

ANNOUNCEMENT.

PROSPECTUS FOR THE ENLARGED PAPER FOR 1892.

LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 1. NEW YORK, JANUARY, 1892. PRICE, { 20 Cts. Monthly. $2.00 per Year.

PROSPECTUS OF *Locomotive Engineering* FOR 1892

With the January, 1892, issue, THE LOCOMOTIVE ENGINEER will take the above title, come out with a large 4-column page, and a substantial increase in the number of them—anyway twenty big pages of reading matter

ANGUS SINCLAIR, for the past six years Editor of the NATIONAL CAR AND LOCOMOTIVE BUILDER, the author of "Locomotive Engine Running and Management," well known as the Secretary of the American Railway Master Mechanics' Association, and JOHN A HILL, Editor of THE LOCOMOTIVE ENGINEER from its birth, have bought out the paper and will devote all their energies to making it the best practical railroad paper in the world.

It is proposed to keep it up to the times and devoted exclusively to subjects interesting to all men in the motive power and rolling stock departments of American railroads.

Old readers of THE LOCOMOTIVE ENGINEER shall not miss a line of Mr. Hill's work, and will in addition secure all the writings of Mr Sinclair

The new owners propose to spend a large sum of money next year for engravings to keep up the interest of every engineer, fireman, shop man and officer in the machinery department

We believe a good monthly is better than a poor weekly

The working, every-day engineers, firemen and shop men of our railroads have been slandered by papers containing little of interest to practical men, which have long contended that enginemen would not read a railroad paper, much less pay for one Four years' experience with THE LOCOMOTIVE ENGINEER has proven the falsity of this claim—16,000 names are now on the list The men *will* read, and profit by it, if practical matter by practical men is furnished, instead of abstract reasoning and cloudy theories Both editors of this paper have bent their backs to the coal scoop and taken care of the reverse lever, the throttle and the 3-way cock "Been there."

We believe that THE LOCOMOTIVE ENGINEER has done good, and we believe that the new and enlarged paper will do much more good; however, we will leave that to you

Now, this enlarged paper will be worth $2.00—can't furnish it a cent less—all we ask is that you will try it for one year; if you are willing to give it up then we won't say a word. Are you with us?

BACK NUMBERS.

We have some hundreds of back numbers of THE LOCOMOTIVE ENGINEER that we will dispose of at once, any, or all, of the four years, at $1.00 per year, unbound. They will be out of print in six months, or sooner. If you want to fill out your set do so now.

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We have on hand less than a hundred bound volumes for each year (only 28 of last year), which will be sold at $2.00 per volume until the supply is exhausted—then there can be no more procured

We have 175 binders on hand that we will sell at 50 cents in the office, or 75 cents by mail, and 38 other binders marked "COMPLIMENTS OF" in addition to the title of the paper (otherwise just as good), which we will sell at 35 cents in the office, or 50 cents by mail. No more of these binders will be made, as they are too small for the increased size of the paper. Order now

ABOUT CLUBS.

We pay a cash commission for getting up clubs. If there is no one at work in your field, write us for club rates

FINALLY.

We do not like to make a lot of promises, blow our own horn and swell up prematurely. We have plenty of new matter laid out, a lot of historical railroad lore as interesting as a novel, some new departments to add, some elementary matter of the right sort, and engravings galore—we propose to lay awake nights scheming to make the paper valuable and interesting to our readers. Our time and abilities shall be all yours. But we would far rather you would tell us how well we have succeeded in a year from now than to blow about it in advance. Will you be on the jury?

LOCOMOTIVE ENGINEERING,
912 TEMPLE COURT, NEW YORK.

ANGUS SINCLAIR, } Editors and Proprietors
JOHN A HILL, }

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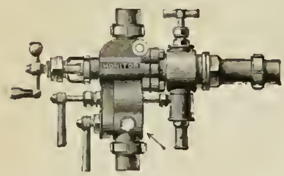

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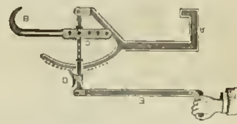

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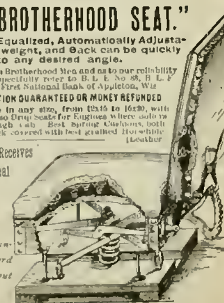

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1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,846	40,563
1887	9,281	40,644
1888	27,896	77,540
1889	26,065	103,805
1890	50,502	154,107

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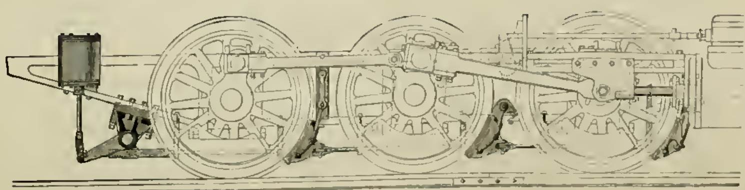

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Standard Outside Equalized Pressure Brake, for Two or More Pairs of Drivers, furnished to operate with either STEAM, AIR or VACUUM.

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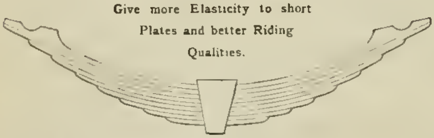

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Freight Cars of every Description, Caboose and Refrigerator Cars,

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DEVOTED TO
THE SPECIAL INTERESTS OF
LOCOMOTIVE ENGINEERS AND FIREMEN
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LOCOMOTIVE MAINTENANCE AND REPAIRS.

VOL. IV, NO. 12. NEW YORK, DECEMBER, 1891. $2.00 per Year or 20c. a copy.

Monumental Scrap.

Out back of the Erie shops, at Jersey City, stands a monument to the memory of the wasted dollars of a man who thought he could improve the American locomotive. The monument consists of one complete "Raub Central Power Locomotive." Just what the inventor of this miscarriage of ingenuity was trying to do it is very difficult to understand—what he actually made is very plain. At a glance, end on, the engine looks like a pile of air drums, tank boxes and ash pans around a boiler front. There are two separate and distinct small boilers of the regular pattern mounted on four drivers each, making eight in all; the boilers have a door on each side of both fire boxes, and none in the ends. The frame is continuous, mounting both boilers; between the fire box ends of the boilers there is a round iron dome or tower, and on each side of this dome there are mounted vertical cylinders, these are in the cab, the heads being taken off through the roof. The main rods are coupled to disk cranks on a master shaft running in boxes on the frame, and rods run from this pin to the crank-pins on the wheels; the links are inside the central dome. From the top of each smoke arch a large square pipe leads back to the central dome, and one smoke stack answers for both boilers. The water tanks are hopper-shaped affairs, located on the four corners of the engine, and there are also four coal bins, holding about a ton each. The air-pump and other rig is all in the cab, and the fireman can dodge around over the engine and use any of the four doors; he has to go out doors to go from one to the other. There is no tender. The water tanks are connected across the frame by six-inch pipes running within a few inches of the track—sure to break off and cause a drought if the engine drops off a switch. Last summer they had this contraption out, and, as might have been expected, she suffered from chills from the start, and was something like five days getting ten cars over a division. But, then, she is "different." The inventor, we believe, is a physician. As an improver of railway motive power he is a failure—not an ordinary, every day failure—but a ripping, howling, sizzling failure.

The employes of the mechanical department of the C. & N. W. have collected $1,500, with which they propose to build a monument to the memory of Geo. W. Tilton, late Supt. of Motive Power. The subscriptions were limited to one dollar each.

Baldwin Compound with Wootten Fire Box.

The engraving shown herewith was made direct from a photograph of a heavy 10-wheeler, compounded on the Vauclain plan and doing service on the Erie road.

This engine has four cylinders, two high-pressure cylinders 14x26 and two low-pressure cylinders 24x26. Steam is admitted to the two high-pressure cylinders by piston valves located back of and between the two cylinders on each side, and the exhaust from the small cylinders passes through ports in the same valve to the two low-pressure cylinders. The back-pressure on the high-pressure pistons is equal to the effective pressure on the low or large pistons, but their areas are so much larger, 3 to 1, that a large percentage of useful work is done.

The boiler pressure carried is 180 pounds per square inch, and steam is admitted to the high pressure cylinders for about two-thirds of the stroke, and then exhausts to the low-pressure cylinder, where it is expanded down pretty low.

The exhausts are hardly perceptible at the stack or on the fire, but the blast is nearly continuous.

This engine is now pulling the Erie's limited train out of New York, although she was built for freight service and has a 62-inch wheel.

The writer recently rode over the division on this machine, and was particularly struck with the speed she was capable of, and the easy riding of the awkward looking craft when running fast. This engine has made over seventy miles per hour for short spurts on favorable track.

Below and between the lower cylinders there are located on each side a combined starting valve and cylinder cock. This valve consists of five small pistons on a rod in a long cylinder which is connected to each end of the low-pressure cylinder, and also by two one-inch pipes to the steam passage in the saddle. When it is desired to move the engine to start, a small lever, corresponding to the usual cylinder cock lever, is moved to a certain location and the valve then admits live steam to the large cylinder and the cylinder cocks are open. Moved a little further the lever causes the valve to close the cylinder cocks and still admit live steam, when a further movement shuts off live steam and the engine is running compound.

The high and low-pressure piston rods, as will be seen, are attached to a common crosshead.

The Baldwin Locomotive Works have built over 100 of this class of compound, many of the earlier ones running in South America, and duplicate orders are now coming in from that country.

The principal dimensions of this engine are as follows:

Cylinders, 14x26" and 24x26".

Piston valves: Travel, 5"; outside lap on high pressure, ¾"; low pressure, ⅝"; lead on high pressure, ¼"; on low pressure ⅜".

Boiler Wootten fire box, 66" at smoke box end; fire box, 114" long and 96" wide; combustion chamber, 49⅝" long; wall of fire brick between grates and combustion chamber, 258 2" tubes, 10' 10" long, total heating surface, 1,672.9 square feet.

The engine has a rigid center truck with journal bearings 5" in diameter and 10" long.

Drivers, six coupled, 56" centers 62" outside diameter, forward pair bald.

The axles have bearings 8" in diameter and 10½" long.

Total wheel base of engine, 22' 10"; driving wheel base, 12'; of engine and tender complete, 50'.

Weight in working order, 182,000 pounds, of which 102,000 are on the drivers. Weight of tender, loaded, 72,000 pounds.

A Heavy Grade in Vermont.

There is a little five-mile road, known as the Barre Railroad, that has a pretty stiff grade, the average being 264 feet per mile. One of the granite quarries that this little road serves is 1,064 feet higher than the town. The engines are Baldwin's, one small four wheel switcher, 15x22 cylinder, and two six-wheeled engines, 16x24, somewhat heavier. The small mill handles four empty cars, and the other two nine empty cars on this grade.

The engines have air brakes, with American driver-brakes, the water-brake, and all modern appliances. The cars have hand brakes. Unlike many, we might say most, private roads, the rolling stock and track are modern, and kept up to date, the line being laid with heavy steel rail, and protected by switchbacks, etc. The Supt. and M. M. of the road, Mr. F. W. Stanyan, keeps things in good shape.

A Good Deal for the Money.

Once in a while—sometimes oftener—a railroad asks far more of its men than the salary paid warrants. They tell a pretty good story about a brakeman who ignored an order to call the names of stations in a "clear tenor voice," and, on being called upon the carpet, asked what grade of a tenor voice they expected for $38 a month.

We recently sat in an office and listened to a civil service examination of a young man who needed to know a good deal, and be a polished gentleman beside, for the privilege of selling tickets for a railroad for the magnificent remuneration of $30 per month.

There are not two railroad managers in the United States that do not expect their master mechanics to know more, do more work, assume as much responsibility, and do twice as much worrying as the engineers under them, and for a third less pay.

Here is a little dog story that is floating around in the papers that fairly illustrates the unreasonable in similar lines:

Fair Customer—"I live in the suburbs, and I want a watch dog."

Dealer—"Yes, mum."

"But of course I don't want one that will keep us awake all night barking at nothing."

"No, mum."

"He must be big, and strong, and fierce, you know."

"Yes, mum."

"Yet as gentle as a lamb with us, you know."

"Yes, mum."

"And he must pounce on every brutal tramp that comes along, and drive him off."

"Yes, mum."

"But he mustn't interfere with any poor but honest man looking for work."

"No, mum."

"If a burglar comes prowling around at night, the dog should make mince meat of him in an instant."

"Yes, mum."

"But he mustn't attack a neighbor who drops in for an evening call."

"No, mum."

"And of course he mustn't molest people who come hurrying in at all hours of the night to call my husband. He's a doctor, you know."

"No, mum. I see what you want. You want a mind-reader dog."

"Yes, I suppose so. Can you send me one?"

"Very sorry, mum, but the only dog I had of that 'ere kind committed suicide yisterday, and I guess the breed is extinct."

Power Dumping Device for Cars.

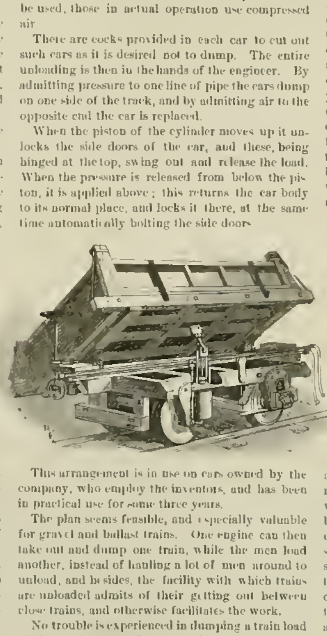
The illustration on this page shows the application of a cylinder for fluid pressure used to dump an ore car.

This arrangement is the invention of Mr. J. H. Gearhart, M. M. of the Arkansas Valley Smelting Co., at Leadville, Col., and W. A. Thatcher, of the same place.

A cylinder is located on the side of the car, and two train pipes and two lines of hose connect it to the locomotive; air, steam or water pressure can be used, those in actual operation use compressed air.

There are cocks provided in each car to cut out such cars as it is desired not to dump. The entire unloading is then in the hands of the engineer. By admitting pressure to one line of pipe the cars dump on one side of the track, and by admitting air to the opposite end the car is replaced.

When the piston of the cylinder moves up it unlocks the side doors of the car, and these, being hinged at the top, swing out and release the load. When the pressure is released from below the piston, it is applied above; this returns the car body to its normal place, and locks it there, at the same time automatically bolting the side doors.



This arrangement is in use on cars owned by the company, who employ the inventors, and has been in practical use for some three years.

The plan seems feasible, and especially valuable for gravel and ballast trains. One engine can then take out and dump one train, while the men load another, instead of hauling a lot of men around to unload, and besides, the facility with which trains are unloaded admits of their getting out between close trains, and otherwise facilitates the work.

No trouble is experienced in dumping a train load while running at moderate speed.

The Illinois Central have put on a special train between St. Louis and Chicago, to be known to fame as the "Diamond Special." Instead of turning over their chair and sleeping cars to the Vandalia at Effingham, Ill., they will run through solid, going into St. Louis on the Vandalia tracks. The Pullman works have recently turned out the cars for this train, and no pains have been spared to make them the most elegant and luxurious cars on wheels. They are named "Felicito," "Delecto," etc. The sleepers are the new design, drawing rooms throughout. As private as English cars.

In Austria there is in use an extensive system of rewards for the discovery of dangerous defects in rolling stock or permanent way. If every track walker got a substantial reward for every broken rail or burned bridge found, and every inspector got a day's pay for every broken wheel found or every cracked side rod that was discovered and recorded, we imagine there would be more thorough inspection and more careful track walking.

The Philadelphia & Reading have ordered twenty Baldwin compounds—the largest order yet given for compounds by one road.

More Electrical Nonsense.

By Fred H. Colvin.

It is little wonder that the engineering fraternity have come to look upon the transmission of power by electricity with considerable distrust. Not that it is not a success in many places, but because of the idiotic claims made by its friends. If these statements were made by men of little experience or knowledge of the business, we might excuse them, on the ground of enthusiasm.

When a man like Frank J. Sprague, who has been connected with the motor business almost from the beginning, gives utterance to such statements as the following, it is time to ask whether they know the truth if they happen—accidentally—to see it.

"Break a single part of the many in a locomotive, and it is helpless," while according to his statement you can break "many of certain parts of an electric motor, and, though crippled, it will still operate." The strange part of the last sentence is the admission that it will even be crippled. Of course we can break many parts of an electric motor and not affect its operation, but let the main conductors be parted, and having no means for repair at hand, you are as "dead" as any locomotive can be with *all* her parts gone. The hundreds of engineers who have come home "on one side" from various causes know well that it takes more than the breakage "of a single part" to make them helpless. Had Mr. Sprague even said vital part, he would not have been absolutely correct, but he did not even so qualify it.

This equals Dr. Louis Bell's statement, that there were sixty-four oil holes under an engine, and "failure to oil any one of these meant accident, and perhaps death to the train."

No one more admires the achievements of electricians than the writer, but achievements to be admired must exist in reality as well as on paper.

No one disputes the advantages that electricity has over steam for many places—the absence of smoke and steam are greatly in its favor; but why not be honest, just for a change.

If Mr. Sprague really believes what he says, we can pity his ignorance, but we must condemn his lack of investigation before making such a statement. If he does know better—and it seems most probable that he does—he must not expect to escape the penalty that follows such willful misstatements—he must not be surprised to have his opinions regarded with distrust. Before the electrical men complain too bitterly about unfair skepticism or a lack of cordiality on the part of the steam engineers, let them be more careful to adhere to facts when showing by comparison the advantages of their mode of transmitting power. The result of the circulation of such statements in the report of a body of men known as the "electrical engineers" cannot fail to work harm to themselves. "You can fool all of the people some of the time, some of the people all of the time, but you can't fool all the people all of the time."

As a locomotive which had been undergoing general repairs was being run out of the Chicago, St. Paul & Kansas City shops at South Park, St. Paul, one day last month, the boiler exploded, fatally injuring three employes of the company, among them being James Dickson, general foreman of the shops, and slightly injuring five others. Examination showed that the crown sheet had given way.

The demand for the M. C. B. type of coupler is growing very rapidly. Within the last sixty days the Janney coupler has been specified for 15,000 cars. The other makes of the same type are largely specified. The Gould is called for by the thousands, the Trojan has just been ordered by the Old Colony, and the Standard by the Central Vermont. The latter order was 250 cars.

The Erie has an old, single pair of drivers, and a tea-kettle, that once upon a time did service upon the six-foot gauge. She is used to move the transfer table and do light switching about the shops. The boys call her "the-fly-up-the-creek."

Sixty Years of Progress.

On the 12th day of November, 1831, Isaac Dripps stepped upon the deck of the "John Bull," at Bordentown, N J, and opened the throttle of the first locomotive in service in the State, and one of the first in the Union On the 12th day of November, 1891—sixty long, eventful years afterward—there assembled at the exact spot where the old "John Bull" stood in '31, a large concourse of people to witness the unveiling of a monument to the memory of the historic occasion.

The old "John Bull"—now resting in the National Museum at Washington—was purchased in England in 1830, by Col. John Stevens of Hoboken. On his way to England, Mr. Stevens whittled out a pattern for a T-headed rail, the first ever made, but had great difficulty in getting them rolled, they were finally rolled in Wales and brought to this country. He also had hook headed spikes made with which to fasten them to the stone blocks used as sleepers—this rail and spike are the standards of the country to-day.

The granite blocks used as sleepers had large holes in them that were plugged with wood, into which the spike was driven

Mr Dripps, the man who set up the locomotive when it came, ran it, and for years afterward was master mechanic of the Camden & Amboy, and superintendent of machinery of the Pennsylvania, still lives at Philadelphia, in the 82d year of his eventful life. Two years ago Mr. Dripps visited Bordentown, and drove a stake at the spot where the monument now stands, and another at the end of the original track, 3,500 feet away. Mr Dripps was, however, unable to attend the unveiling ceremonies, and was represented by his son, Mr. W A Dripps, the well-known mechanical engineer.

The monument is a rough granite block, having a bronze relief of the old "John Bull" and her train as they appeared sixty years ago, with the officials of the State of New Jersey aboard. This picture, from the original tracing, was shown in THE LOCOMOTIVE ENGINEER for March, 1891

The base of the monument is composed of the original stone blocks used as sleepers, and around the monument there is bent one of the original rails held by the original spikes. This rail was 3½ inches high, weighing 42 pounds per yard.

This monument marks an era in the advancement of civilization, and we trust that it may stand for ages, to remind mechanics and engineers how much they are indebted to the men who had no precedents to go by, no examples to follow; but who, groping in the dark, accomplished something of infinite value to mankind, and made precedents and experiments for future generations to stand upon and reach up higher

The Chicago, Milwaukee & St Paul road have ordered twelve heavy ten-wheelers of the Baldwin works, one of which will be a compound. The R. I. works are also building two ten-wheelers for them, one simple and one compound. This plan of the roads, of getting compounds and making comparative tests, not with other compounds, but with simple engines of exactly the same make and capacity, will do a good deal towards proving the economy of the new engines. Tests of efficiency made by George Gibbs, the mechanical engineer of the system, will be accepted by the railroad men of the country as fair, correct and honest.

C Shanks has been appointed master mechanic and master car builder of the Los Angeles Railway, in place of Geo. E. Mosher, resigned. Mr Shanks has heretofore been located at National City, Cal.

The Old Shanghai "Fury."

Some of the gray haired readers of this paper may possibly remember the engine illustrated on this page; she did a lively passenger business in New England over forty years ago

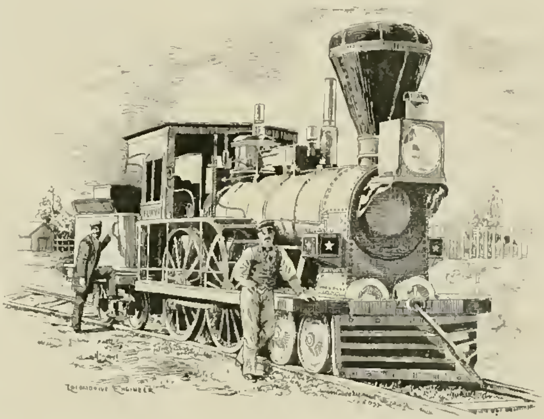
The engraving was copied from an old daguerreotype, the copy being owned by Master Mechanic Wm. H. Taft, of the Boston & Albany

The "Fury" was one of three engines built at South Boston in 1849 by Seth Wilmarth, who afterwards became master mechanic of the U S. Navy yard shops there. The other two are known to fame as the "Falcon" and the "Bee."

The forward man in the picture was the fireman, who has long since passed over to the majority The man at the gangway is Seth H. Ellis, the engineer of the "Fury" forty years ago, who still pulls the throttle on a modern 8 wheeler on the same road Mr. S A Adams, now of Boston, was general foreman of Wilmarth's shop when the "Fury" was built, and afterwards went to be master mechanic of the Boston & Worcester road, the one that owned the "Shanghais," as they were called.

From the memories of these two men we glean something of the peculiarities, the sizes, and the history of the "Fury."

As can be seen from the picture, the "Fury" was an inside connected 8-wheeler, with short front truck, her cylinders were 15x18 inches, driving-wheels 66 inches diameter, her steam ports were 8 inches long and an inch wide. She had the old-fashioned drop-hook motion, and an independent, fixed cut-off, this worked a valve in a separate chest, above the main one, as shown The "Bee" had plain drop hook, and no cut-off, but a longer valve travel.



A SETH WILMARTH SHANGHAI.

The boiler was about 48 inches in diameter, and had 120 inch and three-quarter tubes, 9 feet long. Mr. Ellis does not remember the size of her fire box, but says it looked like a salt box as compared with the one he keeps water over now

These engines all had box tenders; that is, there was no pit; wood was used as fuel, and was piled on top of the water box, a railing being used to keep it on.

Speaking of his service on the "Fury," Mr Ellis said: "I can't remember exactly how long I ran the engine, but it was about fourteen years. I ran all three of them, off and on, and also a freight engine, called the "Bison," also made by Wilmarth, but this was before I took the Saxonville train, which I have pulled continuously for thirty eight years

"Of all the engines I have run in half a century, the 'Fury' was never excelled, for her inches; but I often wonder now how we ever got along without injectors.

"The old 'Fury' was famous for snow, she dived through it as if she liked it. I often had a train of seven to eleven cars on the Auburndale run, and she had no trouble in getting them there with four or five cords of wood

"I have pumped her up by hand many a time in snow or other tight places; sometimes would jack her up so that her drivers would clear the rail, and run her that way to keep her pumped up.

"In snow I have often cut her loose from tender and plowed out a cut alone, and worked the train through one car at a time.

"We had no blowers in those days, but I used to pull her hooks back, and give her light throttle to blow up her fire.

"She had a half-stroke pump connected to crank-pin.

"While I ran her she broke two crank axles; this was the fault of the inside engine design.

"All of the class were very smart, could run like deers, and the 'Fury' had the reputation among the passengers for 'getting there,' especially in winter time."

Long years ago the "Fury," with other faithful slaves of her kind and size, went to the auction block and passed into strangers' hands, and of her final fate none of her old friends seem to know

There recently died at Philadelphia a man who has left his mark on the continent. Moncure Robinson was born at Richmond, Va., in 1802 In early life he became an expert civil engineer, and laid out many of the canals and railroads of Virginia and Pennsylvania. He was one of the first to favor railroads over canals, and laid out many of the original coal roads of Pennsylvania He was at the head of the Beaver Meadow road and was the backer of Eastwick & Harrison, the builders of the "Gowan & Mark," and other famous 8-wheelers of the early days. Mr. Robinson was a man of means, and the moving spirit in many railroad and steamship lines. His greatest work was the establishment of the Philadelphia & Reading road. He secured the money to build it, managed its location and its finances, and his foresight in buying coal lands has given the road the greatest coal-carrying business in the known world. Mr. Robinson has held many positions of trust and responsibility, but for many years has refrained from active work

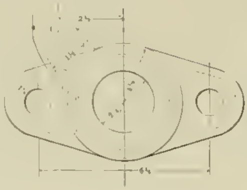
The Pennsylvania Company's Webb compound is in the shop for a new crank shaft This will be fitted with an eccentric to drive the low pressure valve gear. The eccentric is loose on the shaft, and is prevented from turning by a pin that engages stops on a collar fast to the shaft. This eccentric communicates motion to the valve for both forward and backward motion, but has no reverse gear, the high-pressure cylinders move the engine enough to move the low-pressure crank-shaft in the eccentric far enough to cause the second stop to operate the gear for the opposite motion. The engine has been running with the Joy valve motion for some time, and it will be interesting to note if the new gear is an improvement.

Many German engineers prefer masonry to iron for bridges, and they have revived the practice of building masonry bridges with lead joints at the key and points of rupture near the spring lines. The Romans used sheets of lead between cut stone, and in bridges built in England, in 1833, bands of lead were placed in the joints for two thirds of the distance above the springing line. The use of lead is for maintaining the proper interval of joint, and for uniformly distributing the pressures.—*Ex.*

If you want a copy of Phelan's Air-brake Book, at $1, you had best order now.

Some Kinks from the Manhattan Elevated Road.

Once in a while a radical departure from what has before been considered absolutely necessary is made with gratifying success. It has long been considered absolutely essential to success in metallic piston packing that there should be coned rings held into a coned sleeve by a spring, and that the whole should be protected from undue wear by ball joints that would admit of distortion of the rod.



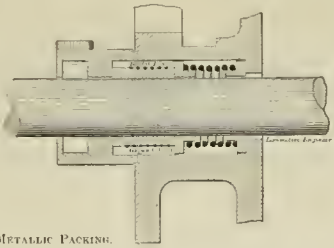
The metallic packing in use on the Elevated Road of New York City is the invention of Mr. B. F. Headley, the general foreman of the shops at Ninety-eighth street.

There are no coned rings and no ball joints. As can be seen by the engraving, the packing rings proper are held against the gland by a strong spiral spring located between the neck ring, and another similar ring sliding loosely on the rod.

Next to the gland there is a heavy babbitt ring (1 5/16" square for a 2¼" rod), and back of this ring there are the three packing rings proper. Each of these rings is in three pieces, as shown in small detail drawing, these rings break joints in their own sections as well as with each other, and when closed on the rod—when new—are left open 1/16 of an inch at each joint; this provides for wear. Each ring is as wide as the diameter of the rod.

When these rings are made they are all fastened upon a mandrel in line, and with a round-nosed tool there is a thread cut upon the outside; the thread just holds half of a No. 11 Bessemer wire. A coil spring of this sized wire is wound with initial tension, that is, so that it requires force to separate the different coils of wire, and this spring is screwed upon the outside of the three segmental rings, this serves to hold the nine pieces of metal together as if they were one piece, prevents their separating and getting out of place, and makes their handling an easy matter.

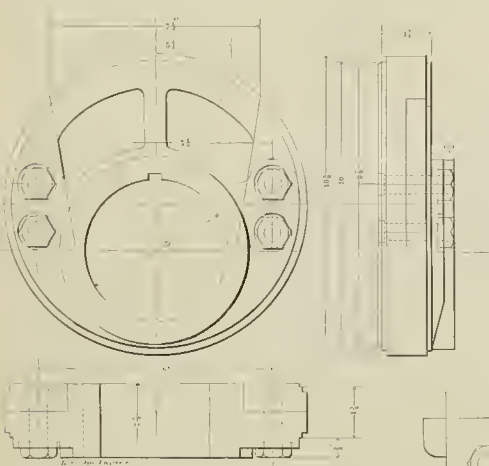
The gland, as will be seen, has an oil cup cast on it, and a large recess is formed below this oil cup, that entirely encircles the rod. A few strands of wicking are passed around the rod and fastened in the oil hole, and this "neck-tie," protected from the dirt and cinders, serves to keep the rod lubricated all around evenly.



HEADLEY'S METALLIC PACKING.

REMOVABLE ECCENTRIC.

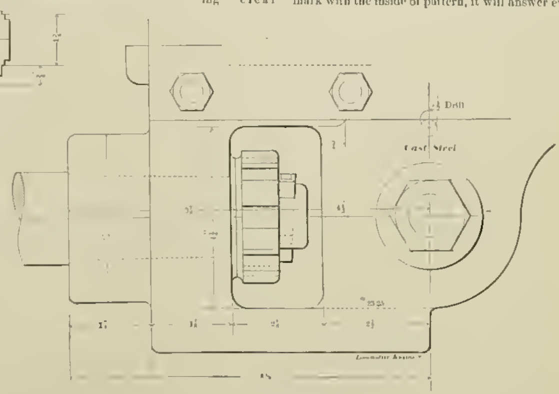
The eccentrics used on this road are small, 10⅝ in diameter on a 5" shaft. They are made in two pieces lapped together and bolted, each half passing beyond the center line of axle. This is made clear in the sketch; this construction is cheap, strong, and not liable to breakage.



ECCENTRIC USED ON ELEVATED.

PISTON ROD FASTENING.

Considerable experience with piston rods broken through the keyway called for a better mode of fastening. Mr. Headley devised the mode of fastening shown. Beam guides are used, and beam guides are noted for doing up pistons, but a cross head was made, with an opening clear through between the end of the piston and the crosshead pin. No keyway is cut, but the rod is threaded back of the taper fit, and a spanner nut is screwed upon it, backed by a strong split key; this leaves the full strength of the metal in the fit, and has reduced the breakages. The piston rods are fastened into the spiders in much the same way.



PISTON ROD FASTENINGS.

Locomotive Cab Construction.

BY WM. NEWTON.

In connection with my duties as pattern maker, I have to see to the building of cabs, and have noticed that to the average carpenter (or rather car builder) cab building seems to be somewhat of a mystery, probably from not having proper confidence in themselves, or not having studied its construction, they are apt to think it requires more skill than they possess. Hoping to give some useful suggestions, I send you results of some of my experience.

In the annexed drawings, Figs. 1, 2 and 3 give general views of an ordinary modern cab, such as is used on large passenger and freight engines, it is known as the closed back type, having doors and sashes as seen at Fig. 3, instead of paneled framing, known as an open back. My experience is confined to a railroad repair shop, where the practice must necessarily differ in some points from that in the locomotive building shops. It will be seen that, instead of the old-fashioned angular roof, it is curved, the only improvement that I can see in the change is it gives a little more space overhead inside. The curved roof cannot shed the rain-water quicker; it takes more material to cover, and also more labor in preparing plates, carlings, etc.

Our first thing will be to make out a bill for the material, which is generally of ash or oak, except the cornice trimmings, water table, etc., which are of pine, and should be got out in numbers and kept in stock. White wood makes good panels, and cherry is often used for sashes, but ash is doing good service for same with us, and it looks nice, simply varnished, in contrast with the framing, painted black.

The mill carpenter will want a template to shape the plates, carlings and tail plate, besides the end facia (see *a*, Fig. 1, *a'*, Fig. 3, and *a''*, Fig. 4); if we make a pattern for the carlings, allowing it a few inches longer than the exact length of carlings, but the same depth and about ⅞" thick, it will answer for all; by marking the outside curve, and then marking off width of tail plate and facia, and then mark with the inside of pattern, it will answer every purpose; this pattern is screwed on to each piece, and used as a guide whilst dressing them on shaper, hence the necessity of its being so thick.

When the framing is ready, the next step will be to "lay it out." Suppose we take the front first, and commencing with the stiles we arrange them in pairs, marking the face and one edge of each, then take a rod previously marked with all the mortises, heights, etc., transfer same to the work, and square across all four, two of which must have tenons to engage mortises in plates; next take one of the muntons and mark the length between shoulders, not forgetting to allow again on the inside the depth of rabbet, as shown in detail, Fig. 9. Where the different pieces are chamfered clear through, a pencil mark run through will be enough, but where stops must be made, as on the stiles, it is well to mark their position at the same time the mortises are located. The thickness of frame being 1⅜" the mortise will be ⅓ of same, equal $\frac{7}{16}$", and as the doors are 1½ thick, one tooth of mortise gauge will answer for rabbet. The same applies to the laying out of back and sides, with the exception of rabbets for sashes; those in sides are arranged for the middle one to slide (see details, Fig. 6). The munton nearest the front measures less than the rest of framing; this will be understood. If we again refer to Fig. 6, also Fig. 8, we shall see an arrow pointing to iron track and brass plate; the track is ⅜" common band-iron screwed to rail, and the brass plate is put on the bottom rail of sliding sash, two plates to each; the part turned up is driven into a saw-kerf made in the end of seeing the mortises will be placed equidistant between shoulders afterward.

If you can conveniently have joint bolt holes bored by machine, do so through stiles and the top plates only, boring the rest, and cutting out mortise by hand. If you notice, the front bolts against the sides, and the back bolts in clear of sides, consequently the bolts must project far enough to engage the front in the former, and the sides in the latter case, which will be two each side of front, and only one each side at back. I use hard wood blocks for the purpose, just the thickness of side when I first "glue up" the work, and by the time everything is ready to put together (the cab) the glue will be set, and the blocks taken off and kept for next time.

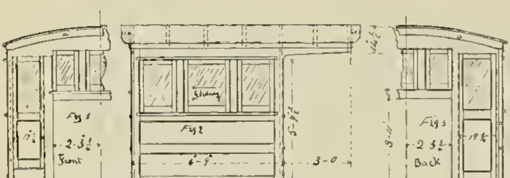
It is best to fit all sashes and hang all doors whilst the frames are lying on the horses. I have plates of iron screwed on the top edge of rail under the front doors, to prevent the wood being worn away.

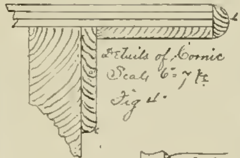
The water table fastened to rail under sashes front should be screwed on without glue, to allow its removal when fitting the "apron sheets," one each side of cab, and bolts passing through same, also through lugs tapped into boiler.

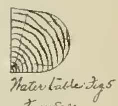
with under edge molded same as *c*, Fig. 4. The circular facia is put on next; then a piece ⅜" thick by 4' wide is bent and well fastened with screws, nails and glue to under side of roofing, and after trimming the ends of roof boards fair with edge of same, and cutting off the corners of roof to receive circular blocks, and mitering with side and end molding, we are ready to complete the cornice by fastening *b* in position, which is a half-round molding steamed or wet with hot water, and well nailed on, bending the same as you nail; care must be taken to let some nails enter both boards of roof, thereby securing the whole.

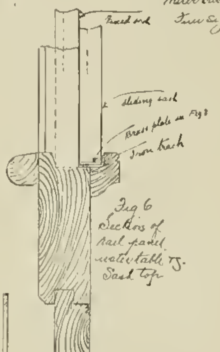
The tail plate is dovetailed, and screwed into the ends of side plates, and of course must be fixed in position before the roof could be put on. Generally we put a quarter round molding around the angles inside, and miter the same to bell-board, which is 10' wide and cut in between back plate and first carling. The details show the panel, also cross-section of sash stop, which is screwed on to frame on top and bottom only.

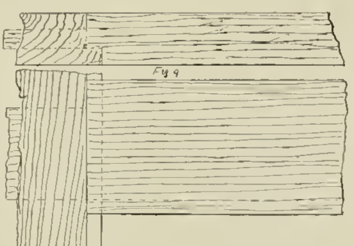
In referring to the method of "gaining" tenons on to the depth of rabbets, as shown at Fig. 9, I was surprised to notice that engines coming from three different builders had square shoulders to











stile about ⅜" in from edge, and the two screws hold it firm. The plate shown in Fig. 7 is used to secure the fixed sashes, two hickory pins are inserted in one stile with holes to match in frame, and the plates are let in across the joint on the other side; it keeps them in place, and is quickly applied.

The doors are hung to open out and against the boiler, whilst those in back open inward. I may remark here that the engineers and firemen do not like this kind of back, as it deprives them of some room which the open kind allows them to use; often their locker is fixed in the back corner, but cannot be with this class.

In laying out the sashes, I find it is best to mark the rabbeted side as face, it gives a better opportunity to gauge for mortises and tenon, it being understood that it is rabbeted and molded before laying out; the rails have a square shoulder, the mold is cut away on stile and mitered at the corners; the side sashes have muntons in them, not shown in our drawing, the mortises for which are laid out after the rails are tenoned, for the reason that only one rail is laid out for tenon; the rest for that size are cut to the length from stops set to the pattern one, therefore less care is exercised

Now, let us suppose that everything is ready to go together, we bolt the four frames together, and after squaring the cab, which may be done by straining a suitable piece diagonally, forcing cab square with a wedge at end of same; then bore all wood screw holes where necessary, and run in screws, after which loosen bolts and screws for one joint, force apart just far enough to glue, then retighten, proceed until each corner is glued and screwed together. I should mention there must be a temporary strip screwed across the back to keep the stiles in position, this same piece should remain until cab is fastened to footboards of engine.

We are now ready for carlings; they should have their ends bored to receive screws, and a half round molding same as we use for cornice *b*, glued and nailed to under edge; this saves the expense of ceiling the cab inside, and strengthens the carlings. I need not dwell on the way they are fixed—they are simply let into side plates, and screwed in position. The roof is made of matched ceiling, planed on the under side only, and extended over ends to give a 5' cornice, it is dressed off true with side plates, and the side cornice molding, which is a piece 1¼' x2' with outer edge molded with same cutter as *b*, next the side facia 2¾' wide by ½' thick,

their cab framing, and stopping all rabbets, leaving short pieces to be soon jarred off, besides making it very inconvenient to work, especially where we have two or three mortises in one piece. If it is found inconvenient to adjust the tenoning heads of machine, then have them cut square, but the depth of rabbet longer, shortening the one shoulder by hand.

The Boston & Albany road has recently been laid with an extra heavy steel rail, and it was at once noticed that engines with well-worn tires were rapidly chewing the corners off the new rail. Orders were at once issued to turn all tires before they had worn $\frac{3}{16}$ of an inch. Most of the driving wheels have already gone through the shop, and you can't find a bad tire on the road. Perhaps if $\frac{3}{16}$ of an inch was the limit of wear on all engines, it would not be so hard to keep up frogs and crossings.

When babbitt starts to dropping silver dollars on the ties, throw out all there is before you stop; if you don't, you will have some fun clearing out the oil hole, etc. As long as a bearing will and can take oil, babbitt will not go.

Tests of Iron and Steel.

The committee appointed by the Railway Master Mechanics Association to investigate the subject of blue shortness of iron and steel have laid out a most comprehensive plan of work. If the tests are carried out as thoroughly as the plans call for there will be material collected for one of the most valuable reports ever submitted to an engineering society. The committee consists of William Smith, chairman; J. N. Barr, A. W. Quackenbush, P. H. Peck, D. L. Barnes.

The following makes of sheet steel, which are those most commonly used by railroad companies, will be tested: Shoenberger, Spang, Park Brothers, Carnegie, Phipps & Co., all of Pittsburgh; Otis Steel & Iron, Cleveland, O., Luken, Centerville, Pa., and Wellman's, Chester, Pa. The work to be done is:

Determine the temperature at which blue shortness manifests itself in a maximum degree.

Determine the tensile strength of iron and steel at this temperature of maximum effect; also, at the same time, elongation and reduction of area.

Determine the effect of bending on samples of the same classes of steel at ordinary temperature.

Determine the effect of bending on samples of the same classes of steel at 30 degrees below zero or more.

Determine the relative endurance of iron and steel stay-bolts after the threads are cut thereon by oft-repeated vibrations inside of the elastic limit, and as nearly as possible with the same degree of bending and conditions that exist in a locomotive fire box.

Determine some means of testing steel rivets to show that, while they have the necessary ductility, they are probably unfitted for boiler work.

Determine some means for detecting laminations in steel boiler plates.

What is the best method of procuring samples of boiler sheets from steel makers in order that there may be no uncertainty regarding their identity? Such samples should not be annealed after being cut from the plates.

What is the best specification for fire box steel?

What is the best specification for shell steel?

What is a good practical test for temperature to be used in a boiler shop to prevent hammering sheets when there is danger of blue shortness?

What is the proper test for steel and iron axles: a small number of large blows, as now used, or a large number of small blows, as is preferred by the Chicago, Milwaukee & St. Paul road?

Can the presence of steel in wrought-iron scrap be detected?

What is a satisfactory test for draw-bar links, and will an old link, which has been used, stand as much as a new link?

What is a satisfactory test for draw-bar pins?

What is the comparative strength of malleable iron, and good cast cylinder iron and cast-steel?

What are the comparative weights of these three metals for equal strength?

Can malleable iron be made more than ⅜ of an inch in thickness?

Is it practicable to etch the ends of all steel crank-pins before they are put in service, in order to determine whether there are longitudinal cracks?

There is a wide difference in the amount of phosphorus and sulphur in fire box sheets by different makers, and it is claimed that there is a vast difference between steels made by the basic and acid process. It is stated that the acid process is vastly superior, as it reduces materially the amount of phosphorus and makes better plates for fire box service. It is stated to be less brittle under a high pressure.

If it is found that fire box plates have a high temperature in service, would it not be well to examine the basic and acid plates to determine their relative values under such heating as is attained in a fire box?

If possible, test the temperature of fire box plates with a heavy fire in progress.

State various curious fractures of iron and steel, and explain reason therefor. The following have been collected:

(*a*) Laminated fire box steel, with a hard and soft structure. C. & N. W. shops.

(*b*) Rivets cracked on inside in bending. C. & N. W. shops.

(*c*) Section of thick piece of malleable iron showing how far the annealing effect penetrates. D. L. B.'s office.

The Telephone Patents.

The basic patents of Bell on the telephone will expire in a couple of years, but the Bell Telephone Co. have enough other patents that "improve" to give them a long term on the monopoly. They have made millions out of it, but they want more. The *Electrical Review* backs them up as follows:

"The fundamental telephone patent will expire in 1893, when the simple method of transmission by magneto currents will be open to the public. The practice of extending the term of patents is one which has fallen into desuetude, and nothing is more improbable than that it would be revived in a case like the telephone. The inventor of the telephone has been enriched for his gift to the public, and deservedly so. With this fact established the chances of extension fall. It must be remembered, however, that the telephone industry of to-day has only attained its present degree of perfection by the coalition of many improvements upon Bell's basic idea. There are hundreds of patented inventions which have been acquired by purchase, which will insure the Bell Telephone Company a firm grip on the business for many years after the fundamental patents expire. First in importance are the microphone patents and the induction coil for raising the tension of feeble microphone currents, and, secondarily, numerous switches, switch-boards and systems which enable the present company to give good service. A competing company can only offer the public magneto transmission minus these improvements, which, of course, will give only inferior results. The bitter tone which characterizes most of the discussions of this subject is unwarranted, and proceeds from a misapprehension of the true position of inventors toward the public. Patent statutes are not purely a benediction of congress on a deserving class of citizens; they are based upon the theory that the public gets a full *quid pro quo*. In order to stimulate progress in the arts an inventor is offered protection of the results of his genius for a period of seventeen years, on condition that he discloses to the public the secret of his invention. The public is the gainer oftener than the inventor, for it frequently happens that an inventor is years ahead of the age, and after securing his patent finds that the times are not ripe for its adoption, so that it lies fallow and comes into use only after the period of protection has expired. In the telephone case, however, the invention at once sprung into general use. Much of this was due to the importance of the invention and much to the energy of the promoters. It is proper that both should have met with financial prosperity. Mr. Bell's success has inspired with enthusiasm thousands of inventors whose efforts have enriched the public. The inventor, as a rule, is poorly rewarded. There are a few cases of distinguished success and we all hear of them; but of the four hundred and odd thousand who have taken out patents, who knows how many have scored failures? Let us rather congratulate those who do succeed than begrudge them an equivalent for services rendered."

To Be the Longest Continuous Railway Line.

The construction of the world's longest railroad is progressing rapidly along the river valleys and across the steppes of Siberia. The western extremity of the road is the mining town of Miask, on the eastern side of the Ural range, and its eastern terminus is at Vladivostok, on the Sea of Japan, making a total length of 4,785 miles, which is nearly twice the length of the Canadian Pacific. Its cost, including surveys, grading, building, stations, rolling stock, and, indeed, everything needed for its construction and equipment, is estimated at $183,825,000—an enormous amount, but profitably invested, and far less than the cost of a useless European war. The country through which the road will run presents no great engineering difficulties, and across the vast plains it will hardly require the grading of a roadbed. It is also for the most part fairly populous, much of it being very fertile and the rest rich in minerals, so that along its entire route the road will open up and develop a country of magnificent resources and of almost inexhaustible agricultural and mineral wealth.—*Exchange.*

Losing a Load.

Once, a long time ago, when the Denver & Rio Grande had just built their first line over the snowy range at Veta Pass, a curious thing happened to a freight train.

Three engines did pretty well to get ten loads on the summit, especially in stormy weather, and twenty empties were enough, and to spare, around the corners and elbows of that steep and winding cow-path.

One night Billy Jamison's train crawled up to the top, and while the helpers got out of the way, and the regular engine got her dose of oil and water, Billy walked ahead through the snow.

When he got to the engine he scratched his head and asked the engineer how the train pulled.

"Hard, you must have had brakes set."

"It's *over*, then," said Billy; "it must be *over*, and standing orders to take empty flats the other way."

"What's that?" asked the driver.

"I've got an empty flat car back there. I don't know where I got it; the boys said they had ten straight loads leaving La Veta."

Bill walked back and counted the cars, and came ahead to the engine again.

"There's only nine loads and an empty. I'll look over my bills."

He climbed up in the gangway, took out his train book, and counted over his bills, calling aloud:

"Coal, coal, merchandise, coal, horses, coal, boiler; one boiler, wt. 29,000 pounds, flat, 16-34; that's the flat, by thunder."

With one of the helpers they crawled slowly down the mountain, hunting one car-load of dead freight that had escaped.

A mile back, at the point of Dump Mountain, there was a twenty-foot swath cut through the snow and brush from the track down the mountain side, that, with the broken stakes on one side of the flat, told the story.

In the spring they hauled the big boiler out of the gulch below with mules, it was little the worse for its roll in the snow and rocks.

Steam-heating men are approaching Mr. James T. Furber, general manager of the Boston & Maine, these days, with bated breath, expecting to hear talk that is more emphatic than refined. They feel drawn to that part of New England where Mr. Furber holds forth, because they know that power greater than their own is making steam heat a living issue even for the Boston & Maine, but the wrestling of the head of the road with the inevitable is said to be fearful to behold. We would say to our steam-heating friends, be of good cheer. The man with the most assurance will get there.

Again we would remind the enthusiasts who are going to accomplish wonders with a long valve travel that they have forgotten one important item, *i. e.*, the steam shovel to fire their improved engines with.

Correspondence

Those Glasses Again.

Editor The Locomotive Engineer:

In your comment on my letter in regard to those worn lubricator glasses, you said that the glasses were worn just where protected by rubber gaskets. Now I think that is a mistake. They are not worn *where the gasket is around* them, but *above* the gasket. The glasses are all cut so that they extend past the gasket from one-quarter to one-half an inch, and it is this part that is worn away. Please examine and see if this is not the case.

Seymour, Ind. SAM'L M. HUFFMAN.

[Why not make the glasses short enough so that there will be no end to cut?]

Why Kalfus' Injector Wouldn't Work.

Editor The Locomotive Engineer:

In answering Mr Kalfus' injector question, would say that if all joints were tight, and injector was in good order, the check valves on boiler had not the proper lift, allowing too much back pressure. EDW. GIBSON.

Wilmington, Del.

That Waste Plug.

Editor The Locomotive Engineer:

Replying to the inquiry of Mr. Paul Synnestvedt, in the October number of THE LOCOMOTIVE ENGINEER, I would say his question is pertinent. Mr. Scott, to whom the matter was referred, states that the bunch of waste was found by unscrewing the union nut from car drain cup, massed in its meshes; that, in his opinion, the air exhausted from rear end of train pipe drew the waste out in the pipe in such a way as to admit of its passage, while if drawn from front end of train line, caused the fiber of the waste to draw into the meshes of drain cup strainer and clog its passage.

Nickerson, Kan. T. PAXTON.

Who Can Explain This?

Editor The Locomotive Engineer:

I have been running a Baldwin motor for some time. They are saddle tank engines. At the engine house there is a water tank, which is supplied with water siphoned into it by steam from the boiler of motor. This water is allowed to get cold before using it, but in two or three hours it becomes so hot that the injectors will not work it. Now, at one end of the line there is a tank which is supplied from springs by a ram. This water never gets so hot that we cannot work it, unless the engine stands under steam several hours. Can you explain the cause? The injectors are No. 3 Monitors, and are in good condition. Understand, the conditions are the same, the engines use a tank of water—making a round trip, which is about seven miles—and make steam as freely with the water of one tank as the other. The cold spring water is impregnated very slightly with lime, the other shows no trace of it. JAMES H. HEVEY.

Rome, Ga.

Taking Chances on His Skin.

Editor The Locomotive Engineer:

We have an engineer here who is running an engine that, according to all known laws, ought to break a rod or a pin and send him to glory and the engine to the scrap heap, but it is not his fault entirely.

His engine broke down recently and got a new main pin; the brasses of the side rod were left very tight between the pins and loose in the straps. This he reported and kicked about, but when the roundhouse gang attempted to line up the rod they could not get the strap bolts out—they were partially sheared, and they broke some of them. Being short of engines, they sent this one out on a fast freight in this condition, and she is going out again.

Should the side rod break, the engineer will probably get ten days for "injudicious use of sand." Don't you consider this careless?

Rotterdam Junction, N. Y. IGNORANCE.

[Should the side rod break, the engineer may be so sure of his future that he won't care for the ten days' lay off. We do not consider the conditions mentioned as "careless"—they are criminal.]

Eccentric Moving.

Editor The Locomotive Engineer:

In reading Brother Hitchcock's article on moving eccentrics, an idea struck me which I will advance and see if any one thinks it worthy of consideration. We will suppose the engine is blind, and I wish to give her ⅛ lead. I would put reverse lever in extreme forward notch, pinch engine ahead and catch front center. Now before moving eccentric would mark it on shaft, then move it forward until I obtained the required lead, and note how much my marks had separated, then mark it on shaft again plainly. Would then loosen set-screws, disconnect eccentric blade from link, and push eccentric out into the middle of shaft. Would then mark and move the back motion eccentric the same distance I had the forward one. I think this would give the exact lead without a second trial. Am I not correct? I thank Brother H. very much for his information. J. W. KALFUS.

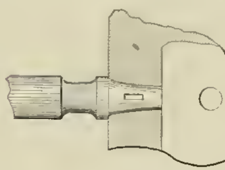
Aspen Junction, Col.

On the Breaking of Piston Rods with Laird Crosshead.

Editor The Locomotive Engineer:

The Laird crosshead was at one time considered the crosshead for locomotives whose design called for one of the driving wheels to be placed inside the guides, which limited the width of crosshead and guides that could be used. But time and use have developed defects in it that are causing it to lose its once popularity. One of the defects is the strain it permits to be put upon the piston rod at the shoulder next the crosshead, causing the rod to break at that point. To remedy this, some roads put a fillet on the rod in place of the square shoulder, and others turn the shoulder off, tapering the rod back for some distance from the crosshead. Either method is superior to the square shoulder, the first is not of as much benefit in preventing breakage as the latter, while if the taper in the crosshead fit of the rod is not sufficient to withstand the compression the loss of the shoulder is apt to cause the piston to work loose in the crosshead.

It is well known that the cause of piston failure with the Laird crosshead is due to the overhung crosshead swing when the piston is on the return stroke. If the line of force between the piston head and crank-pin could be maintained there would be no trouble, but as this is a condition that cannot be maintained in a locomotive in service, it must result in a bending strain on the weakest part of the line, and that is at the shoulder on the rod. The four-bar guide effectually resists the line bending, as also does the top guide in use on some roads with the single bar on top and bottom of the crosshead, putting a fillet at the shoulder strengthens the part but little, and turning it off, beside the evil mentioned, while it distributes the strain over a larger distance, still leaves a sharp point at the crosshead, at which the bending must suddenly cease. The object is to divert the strain from the rod at that point, and to distribute it over as large a portion of the rod as possible, and this can be done by turning the rod down, as shown in the sketch.



There need be no fear of weakening the rod. As the measure of the strength of a body must be its weakest part, and as the piston's weakest part is at the notorious keyway, the rod can be reduced to an area a little above that at the keyway with safety, but it is not necessary to approach that; reducing the rod to a diameter less than that at the crosshead at the shoulder, will divert the strain from that point, and the longer the reduced portion can be made the better it will be.

Albany, N. Y. J. D. C.

What do Water-brake Handlers Think of This Theory?

Editor The Locomotive Engineer:

I do not agree with you in your answer to Question 65, as I hold the water-brake *does* have influence on the injector. T. J. H.'s injector breaks for the following reason, when running in reversed position. The cylinders of a locomotive running in this position serve as two air-pumps, by which compressed air is forced into the boiler through the dry pipe, the mouth of which is located in the same dome that the dry pipe to injector is located. The air thus pumped joins with the current of steam passing down the dry pipe of the injector, causing it to "break," as no condensation takes place. The water brake prevents this, for the following reason: The *jet* of water turned into the exhaust pipes is converted into steam. *This* is forced into the boiler through the dry pipe, and this steam may join with that on its way to the injector, but will not cause it to break, as condensation *will* take place.

Huron, South Dakota. W. W. W.

[How does W. W. W. account for the engines that are let down off mountains with the water-brake with the throttle closed solid? Very few men will use more water in the cylinders than will work out of the cylinder cocks.]

Enginemen Who Missed Their Calling.

Editor The Locomotive Engineer:

I don't know what I said in my article that should offend. I did not say all firemen, only quoted an individual case; but I do say there is a class of men who would never make good engineers if they had a locomotive shoved down their throats, and any observant M. M. will say the same.

The whole path of life is strewn with the wrecks of men who undertook to do something they were not fitted for. The writer was one of a lot of apprentices in a railroad shop; one of the number was the late Wm. Woodcock, Supt. of M. P. of the C. of N. J. He had the five talents and became a master mechanic. Of the rest of us, some had only one, others none, and what was the result? All started out with the same chances. At the close of our four years apprenticeship some of the boys abandoned the business because they were failures in a machine shop. One of them would have made a good lawyer, the others had better remained on the farm. One did his first firing for the writer of this, and at last accounts was pulling passengers in Texas; he was a better engineer than machinist. Under the circumstances I don't know why any one should object to my claiming there are men who will be failures as engineers.

Some time ago the claim was made that railroad companies were getting things down fine, and that the boys would have to keep step; and so they will. The status of the American locomotive engineer is being raised to a higher standard, and it is right it should be so; furthermore, the system of examination, other things being equal, is going to help bring it about.

Who are the men that will be called on to take the throttle of one of our modern flyers? It is not going to be the oldest man in all cases, unless he is up to the standard; it is no place for an old man in his dotage, a young man in his nonage, a nervous, or a reckless man. It requires a clear, cool head, with good judgment and keen sight—a man that can think and act at once, a man of nerve. It takes *sand* to run one of these flyers; in fact, it requires certain elements in the make-up of the man that his examination, or the time card, cannot supply. Mr. Bruce quotes men on the P., C., C. & St. L., who may not know much about petticoats, but who are able to give me some pointers. That is all very true; a man need not know a great deal to tell me lots that I don't know. I said a railroad man would not have to draw very hard on his imagination as to the *result, if that side rod had slipped off the pin.* The collar on the main pin was keeping the forward end of the side rod on, and must have had a tendency to keep the back end on, but that don't alter the desperate risk the engineer took in running a passenger engine with an eight-foot side rod and no collar on the back pin, for over a hundred miles.

In regard to flagmen, I do not condemn them as a class, but if there is a murderer in the sight of God and man, it is the flagman who neglects his duty in times of danger, and causes the death of a score of better people.

Men have died at their posts on railroads, but they did not do it from choice. They stick by their train with the faintest hope that they may get out all right, and try to get out when it is too late.

Corry, Pa. W. DE SANNO.

Same Disease As Other Air-brakes.

Editor The Locomotive Engineer:

On a three-car passenger train on a mountain road they had trouble with the air brake on a sleeper and cut it out.

This is the way she acted. In going down a long hill the engineer would apply the brakes gradually by letting about 8 pounds escape from train pipe, service stop, bringing his handle back "on lap."

The brakes on first two cars would respond, the brake on the sleeper would not commence to set

In perhaps half a minute, or less time, the sleeper brake would apply with a bang through the quick-action principle of triple valve.

The train pipe pressure would reduce about 10 pounds—in applying the sleeper quick-action—and this sudden reduction would apply the brakes on first two cars quick-action, and the train would almost stop before the brakes could be released.

Everything was in normal condition except the sleeper. What was the matter?

Deadwood, So. Dak. BLACK HILLS.

The Air-brake Nut.

Editor The Locomotive Engineer:

In reply to the article in the last issue of THE LOCOMOTIVE ENGINEER, under the caption of "A Nut for Air-brake Manipulators," would say that the trouble was remedied by removing the obstruction in the hose, which partially clogged up the opening.

It is quite evident from the fact that there was sufficient air in the train pipe to set the brakes on the cars at the rear end of the train, that there was an opening through the entire length of the train pipe which permitted the air to flow from the main reservoir to charge up train line and auxiliary reservoirs. The size of the opening through or by this obstruction might have been such that when engineer's brake valve was thrown to the full application position the air could not pass fast enough from behind the second car towards the engine to make a sufficiently quick reduction to move the triple valve pistons enough to close the feed ports, in which event the air as it gradually reduced in the train pipe would also cause a similar reduction to take place in the auxiliary reservoirs by the air returning to the train line through the feed ports provided for charging them. In this case it would be impossible to apply the brakes from the engine behind the two forward cars, but it would be possible to apply the brakes by opening stop-cock at rear of train or uncoupling hose at any intermediate point, and, upon closing this opening, air from the main reservoir would gradually accumulate in the train line until such time as the brakes were all released. K.

Chicago, Ill.

Water-brake Manipulation.

Editor The Locomotive Engineer:

I am glad to hear from the boys on the water-brake question, but cannot agree with Black Hills on certain points. He says: "No water should strike valve or cylinder for water-brake to work successfully. What you want to show at cylinder cocks is steam, not water When an engine's valves have been washed with water the reverse lever will pull you off the seat," etc.

I think there should be sufficient water in cylinders to show at cylinder cocks continually while using the water-brake. In regard to reverse-lever pulling me off the seat, it was caused by cylinders not getting any water, instead of valves being washed with water, for, as long as I had it coming out the cylinder cocks, I had no trouble with the lever, but if the water stopped it would begin to buck. If Brother B H.'s idea of using steam instead of water is correct, why would it not be better to have the valve placed on top of boiler, instead of below the water line? I think the theory advanced by George Shuart is very good, but there is not enough straight track here to give it a fair trial; but the engine I spoke of as handling her water about right, did not throw it out on the stack on the curves or straight track either, but it came out of cylinder cocks as long as I had the water valve open. Of course I could throw it out by giving her more water, but, by being careful, could keep a sufficient supply in cylinders, and not wet the jacket. Had it not been for this engine I should have taken it for granted the water-brake could not be used without drenching the jacket; but if one engine will handle her water in this way, why cannot all be made to do the same?

I often get into an argument with the boys on the water brake question, and most of them are against me, the majority of them think it is very injurious to valves, cylinders, packing, etc. I claim that, if properly handled, it is not. My idea of proper handling is this: On approaching the summit, I open water valve until exhaust sounds like boiler was being overpumped; I then know that water pipe is not corroded or frozen up. As soon as I start down I give the valves a good dose of oil through the cups, open water valve, and wait until I think exhaust cavities are about full, or until I see a spray shoot out the stack. I then reverse engine and start lubricator, and gauge the supply of oil by the way my reverse lever acts. On reaching the foot of the hill I close water valve, and run far enough to get water out of cylinders; then throw lever ahead and churn water out of exhaust passages, then give her another dose of oil through the cups Now I claim that the only way it hurts the valves is, they wear faster by the reverse lever being hooked up coming down hill, than if valves were at full travel. R. B. Reading's answer to my injector question is probably correct; yet the machinist told me he could find nothing wrong. The steam pipe and valves between boiler and injector were all right J. W. KALFUS.

Aspen Junction, Col.

Explanation of Air-brake Tricks.

Editor The Locomotive Engineer:

Having had a little experience with the automatic air-brake, I thought I would dig up my little hammer of knowledge and try to crack "G J. H.'s" air-brake nut, which appeared in your November issue. If I rightly understand him, he says, where pressure on train pipe was reduced through brake valve on engine, brakes were applied on the two head cars only, but when reduction was made through stop-cock at rear of train, brakes were suddenly set on whole train (15 cars). That being the case, I would locate the trouble between the second and third car from engine, possibly some obstruction in hose or train pipe, which prevented sufficient reduction being made back of that point to cause action on triple valves—that is, when the reduction was made from engine, but when made from rear of train the obstruction (if such it was) did not prevent the air from passing freely from train pipe, thereby setting brakes on whole train. My reason for thinking the trouble was as I have stated is, that I once had a like experience myself, and, with your permission, I will relate the circumstance for the benefit of others, as the same thing may happen again.

The action of the brakes in my case was exactly the same as stated by "G. J. H.", when reduction on train pipe was made from engine, the brakes were applied on three head cars only; but when made from rear of train, the brakes were set on whole train (17 cars), and that, too, with a vengeance. After testing the brakes in the manner stated, I came to the conclusion that the trouble was between the third and fourth car from engine, and upon examination I found the difficulty in hose on forward end of fourth car, the hose being an old one, the inside rubber lining was cut or broken where hose was clamped to nipple on train pipe, and loosened up some four or five inches inside; so when pressure was reduced from engine, this loose rubber would roll up in a wad, completely stopping up hose, thereby preventing reduction being made back of that point sufficient to cause triple valves to act; but when stop-cock at rear of train was opened, the force of the air in that direction would cause the loose rubber to straighten out, allowing the air to pass freely from train pipe, setting brakes on the entire train. Defective hose being replaced by a new one, there was no more trouble with the brakes.

With regard to De Sanno's question, I can see no cause for driver brakes to act as he stated without some sudden reduction of pressure from main reservoir or train pipe, perhaps his engine was arranged like some that I have seen: a small pop was placed in end of main reservoir, or train pipe in cab, and set to a certain pressure; when pressure would exceed the limit of pop the air would suddenly escape and blow down to pop limit again. I have seen engine tender brakes fly on from this cause and remain on until pressure was again equalized, which generally required but a few strokes of pump.

I hope some one can explain, as information is what we are all looking for.

Colorado Springs, Col. F. F. D

The "True Inwardness" of Cunningham's Breakdown Puzzle.

Editor The Locomotive Engineer:

I will give you the "true inwardness" of the Cunningham puzzle. In January, 1871, Alex. Cunningham was hauling passenger trains on the Mobile & Ohio R. R. between this city and Columbus, Ky. His engine was a "Danforth & Cooke," built "before de war"; it was a 14'x22" cylinder, and a 5½-foot wheel, and was burning wood.

At this time passengers and baggage were transferred from Columbus to Cairo by the steamboat Geo. Anderson, and the steamboat waited one hour only for the trains from Mobile when late. One day Alex left here on the P. M. train, which got to Columbus after dark. After proceeding some distance from here, he all at once discovered that his engine did not have a full complement of exhausts, and, as a natural consequence, stopped to find out the cause. He looked at his eccentrics, and found them O. K. (which, by the way, were not keyed on). He then formed a natural conclusion, that the yoke on right valve was broken, and did just what any *good engineer should have done, i e.*, he knew his quickest way was to disconnect that side and proceed with the other, and not get behind his hour which the boat waited for him. This he did in a most satisfactory manner to all concerned.

After arriving at Columbus he put his train away and reported, "*Valve yoke broken right side.*" His train was not due to leave until the next afternoon. The next morning the foreman of roundhouse had a machinist take off the right steam chest cover, and when Alex. got there they commenced to "guy" him, as is usual with machinists when they think a "fireman engineer" has made some mistake such as it would be impossible for a "machinist" to do.

Alex. looked at the yoke, and failed to see anything wrong with it He then told them it must be in the cylinder. The foreman insisted that he "just dreamed" that there was something the matter. So he had the engine connected up to show that there was nothing the matter; but Alex. insisted it was in the cylinder, and had them take off the head while they were waiting for steam. The engine stood on front center on right side. When the cylinder head was taken off the piston was apparently O K, and the head was put on by the machinists—who were having lots of fun.

When steam was up, the foreman had Alex. move the engine, to show him that there had not been anything wrong; but the engine started, and it would have done *Puck's* artist good to see the satisfaction there was on that foreman's face; but before one revolution was made the expression changed. Three exhausts was all they could get out of that engine—then the guessing match begun.

Some thought the yoke was cracked, and sprung, etc. The foreman insisted that the eccentrics were out, so he went under engine to see, all hands had ideas of their own. Alex. insisted that it was in the cylinder, and that made the machinist mad to think one could doubt his say so, and he had said, "There is nothing wrong in there." The foreman ordered the chest cover taken off again, and Alex and his fireman took off the cylinder head and found piston same as before, looking O K., and the machinist was more than "jolly" to see that he was right. Alex said he would look at the packing (which was of the Dunbar type), so he put the socket wrench upon a follower bolt, and his fireman took the regulation steel bar to take out the follower bolts. When he pulled down on said bar, behold the piston head turned around in cylinder, and further examination showed the rod had broken off close to the piston head, and had gone far enough ahead to allow the packing rings to drop into the counterbore, which was made with a square shoulder, like all "Cooke" engines, and many others at that time, as it was believed by many engineers that the packing would run much better with such counterbores.

Should you or any of your readers have any doubt about this "railroad story," I will say that Mr. Benj. S Herring was M M. at the shops here, and that James Benson was foreman of engines, or roundhouse, as it was then called, and his brother Samuel was general foreman of the back shop, any of which will give you proof, should you feel like doubting an engineer's story.

Hoping that the Traveling Engineer will get his "puzzle" in better shape next time, and that this one has done some good in causing some thinking to be done by engineers and firemen.

Jackson, Tenn. "ENGINEER."

["Traveling Engineer," after reading the above, says that it must be right and his informant wrong in saying engine made a second trip. T. E. says he has been "guyed" pretty thoroughly, but that he has been pleased to see the way the boys take an interest in practical discussions—especially when they are impractical.]

Danger of Brake Application from Rear Car.

Editor The Locomotive Engineer:

In THE LOCOMOTIVE ENGINEER for November, on page 207, I find a letter from G. J. H., San Bernardino, Cal., asking for an explanation of the following phenomenon:

On a fifteen-car freight train equipped with the Westinghouse quick-acting air-brake, in testing brakes previous to descending a grade of over 200 feet, after exhausting thirty-five pounds of air from the train pipe through the engineer's brake valve, it was found that only the brakes on the two first cars next to the engine had been applied. At the same time an emergency application was obtained by exhausting the air from the train pipe through stop-cock at rear end of caboose. The cause of the above was undoubtedly an obstruction between the triple valves of the second and third cars, said obstruction very likely being at air strainer of the third car. On page 167 of THE LOCOMOTIVE ENGINEER for September is a letter from Mr. T. Paxton, Nickerson, Kan., describing a similar occurrence on the A., T. & S. F. R. R., in which, on a thirty-car train, having twenty-five cars equipped with the Westinghouse brake, the brakes on only the first seven cars could be applied from the engine, while *all* the brakes went on with a "snap" when the rear stop-cock was opened.

Upon examination the cause of the trouble was found (to quote Mr. Paxton's words) to be "a plug of waste in the train pipe behind the strainer, which drew into and stopped it up when the train pipe pressure was reduced from the front end, preventing any reduction back of that point, but when the air was exhausted from the train pipe through the rear stop-cock, the plug was drawn away from the strainer, allowing a uniform reduction to be made the full length of the train pipe, and the consequent application of the brakes."

The above two cases occurring in practice should be taken as warnings against the very dangerous custom, prevalent in some quarters, of testing the air-brakes from the rear of the train; for, under conditions similar to the foregoing, this test may apparently indicate that the brakes are in working order, whereas, in reality, such is not the case.

New York. EDW. L. COSTER.

Good Advice from the Far West.

Editor The Locomotive Engineer:

A great deal is said nowadays about practice and practical men.

This is all very well, I am an advocate of practice and practical men, but there is a point in regard to getting this practice that I want to make.

Men do not make the best use of their own experience, and very few make any use of the experience of others.

Angus Sinclair says: "A belief prevails among men who labor principally with their hands, that laziness is exclusively physical. This is a mistake. It is a psychological fact, well known to metaphysicians, that mental laziness is prevalent enough to dwarf the minds of half the human race."

As the readers of THE LOCOMOTIVE ENGINEER cannot be accused of mental laziness, from the fact that they read it, so what is said here is for those "other fellows" who do not read anything pertaining to their business.

Make the best use of your own experience. If you have a breakdown, know the *why* for everything you do in disconnecting. If one of your air-brake cars won't work, or acts peculiarly, study out what the trouble is, and how to fix it. Don't let the same thing occur day after day, and "cut 'er out" when a little work with your brain will tell you what is the matter and how to fix it.

This approaches mental laziness. I once knew an engineer who never would put his brake valve on "lap" when he broke in two with air-brake cars. Finally the air brake school came, and an examination, and in that examination our friend was asked:

"What would you do if you were running along the road, with a train of air-brake cars, and they broke in two?"

He scratched his head, stammered, and said, "I know, but I can't just exactly tell it, somehow," and the question went to the next who said he would put his brake-valve "on lap," and he also explained how that would hold his main reservoir pressure, so when the stop-cock was shut off behind the last car broken off, he could release all the brakes on cars attached to his engine, back up, couple up and go ahead. Our friend's face lit up; the molecules of his brain had commenced to vibrate, and he realized for the first time in his life the importance of saving his main reservoir pressure in case of bursted hose or break in two.

That same afternoon our friend was called for an extra, all air, he coupled onto the train with the examination fresh in mind. He pumped up and charged his train, tried the air, and with his brake valve in running position, securing his twenty pounds over pressure, he pulled out. He hooked his engine well up, and pulled his throttle well open.

Bill, the fireman, found she was steaming better than usual; he was not using as much coal nor as much water, and everything seemed to be running smoother than usual.

They had not gone far, however, when they struck a low joint, and our friend unconsciously dropped into the same old rut. (These ruts are terrible things. Ask Bill if they are not.) He had forgotten all about his instructions on the expansion of steam, and he hooked her down a couple of notches, and eased off on the throttle as in "ye olden time."

The fire was getting dirty, and Bill was hoping something would happen, so he could get a few extra pounds of steam and a little surplus water, when, bang went the quick-action brakes, and soon the train was standing still, broken in two. What did our friend do? He just sat on his seat, left his brake valve in release position, and lost every pound of air from his main reservoir.

The brakeman had to bleed every car, because the engineer had nothing to release them with till the pump had done a large amount of hard work. They could not wait for the pump to pump them off, for they were making the next station, on short time, ahead of a passenger train. Perhaps if the engineer had to crawl under these cars to bleed them, this bit of experience might have been remembered next time.

Profit by your own experience, and study and profit by other people's experience. Get out of the rut, and what is most important, keep out.

Deadwood, S. D. BLACK HILLS.

Reminiscences of a Government Engineer at the Front.

Editor The Locomotive Engineer:

On page 202 of your November issue I find the following: "On the Western & Atlantic Railroad, famous for its war memories, down below Dalton, Ga., there stands an old car body now used for a tool house, bearing on its weather beaten sides this legend, 'U. S. Military Railroad, Engineering Department.' Ah, what stories that old car could tell."

What has become of the men who could tell you the history of that old car? No doubt many of them are yet in the land of the living. My first acquaintance with it was when three of them came to Chattanooga in the spring of '64. If my memory serves me they were designed and built for the use of the Military Engineering Department for the signal service, several stations of which were located on the line of what was then commonly termed the "State Road," Western & Atlantic.

These stations were located at different elevated points at convenient distances from each other, and a system of flag signaling established between the different army corps; and, in the event of any interruption of telegraphic communication, communication could be carried on through them between Chattanooga and the front. Those cars were designed for the use of this signal corps, and carried the officers, men, and instruments of the corps, as circumstances required.

All engines and cars were marked with the same letters, U. S. M. R. R., with the usual numbers. Engines were numbered from 1 up to, I can recollect, as high as 160. Some of the first numbered engines were second-hand ones from northern roads, widened from 4' 8½" or 4' 10" to 5-foot gauge. I can remember some of them—the Hercules and Jupiter from the Little Miami, 8-wheelers, two 10-wheelers from the 3-C.'s; the Bellefontaine from the B. & I. (Bee Line); the last was a small passenger engine, Taunton build, and is the first one I run after entering the service of the government as a locomotive engineer, in the spring of 1864. Her rates were three loads between Chattanooga and Cleveland, Tenn.

Early in the spring new engines began to arrive, and the small fry were consigned to the "refugee track," in the rear of "Old Tom Webster's shop." All engines were double-crewed except the 44, a Breeze & Kneeland. Our runs were from Chattanooga to Cleveland, on the E. T., V. & G., 26 miles, and to Ringould, on the State road.

The following are the names of the engineers at that time running out of Chattanooga: Geo. Duzenbury, Sam Laird, Chas. Sherman, Ben White, Wm. Freeman, Mose Rogers, Geo. Brown, Pete Thomas, Larry Gaghen, Jas. H. Hevey. Thomas Smith was engine dispatcher. Up to April we had a tough time keeping Uncle Sam's army—which wintered at Cleveland, Graysville and Ringould—fed. After April Col. McGinnis began sending engineers to the front. The army moved, and all engines being double-crewed, they never got cold. In the yard we had Jim Hewitt, Mike Bird, Charley Miller, and Jack Beal to turn them on the Y, get water and wood, and send them out as fast as they came in.

Up to July 16, 1864, we ran by orders something after this style: "Engines Nos. 133, 134 and 135 will meet engines Nos. 126, 128 and 129 at Graysville." There was no superiority, the orders were emphatic, and no trouble ever experienced, rear collisions few. All trains were supplied with a train guard of soldiers, who soon became expert brakemen, so that trains at the slow speed we ran could be stopped very quickly. For fear of becoming tiresome, I will shut off by telling you that myself and Charley Briggs, with Conductors Ostin (Legs) and Jas. Sanderson (Three-fingered Jack), with Baldwin Engine 26, hauled the timber for the historical bridge built by McDonald over the Etowah River, under penalty of being placed in the front ranks with a musket if he did not finish said bridge in a very short specified time. Mc. saved his "bacon," and had about 13 hours to spare. I ran the engine over the bridge that number of hours ahead of Sherman's schedule. I also ran many times over the celebrated pole bridge built by Gen. Rosecrans across the gap on Sand Mountain.

Should this meet the eye of any of the "old time" government locomotive engineers that ran out of Chattanooga in '64 and '65, I would like to hear from them. They can reach me through the columns of THE LOCOMOTIVE ENGINEER, or address Dummy Engineer, J. H. HEVEY.

East Rome, Ga.

[Reminiscences from enginemen who ran at the front for either army will be welcomed to the columns of this paper—the experience of those days reads like novels to us younger men.—ED.]

None of the railroad men in charge of roads doing a suburban business out of New York, believe that the underground road proposed by the rapid transit commissioners will be built, or that its operation is feasible.

Using too much sand on a hill is a pretty sure way to stick; every grain of sand that stays on the rail back of the drivers does hurt, in that it makes the train pull harder. Jet apparatus that deposits a slight sprinkle of sand under the drivers is a grand improvement over the old, free-for-all way of pouring ten times too much sand on the rail. There should be moderation and horse sense used in all things about a locomotive. Water is very essential to the welfare of the boiler, but when its level is raised to the diamond in the stack it becomes a danger.

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CONTENTS.

Send for Car Coupler Gauges.

The great loss of life that goes on constantly among men engaged in coupling freight cars, led to a far-reaching agitation in favor of the adoption by railroads of some form of automatic coupler. Most of the interests concerned admitted readily that an automatic coupler was necessary, but there arose great conflict of opinion as to what kind of coupler was best adapted for being made automatic, and for being forced into general use. Railroad managers preferred that their mechanical officers should settle the question as to the most suitable type of coupler; and the battle on this problem was fought year after year in the conventions of the Master Car Builders Association. After years of agitation and discussion, the Master Car Builders Association in 1887 adopted as standard the vertical plane type, whose best known representative was the Janney coupler. That was merely a beginning of the settlement of this question. The adoption of a type of coupler intended to be automatic entailed duties upon railroad mechanical officers that previously were never thought of. With the adoption of a standard type came the necessity for securing uniformity in the essential elements. The association had previously adopted numerous standards, and it was well known that the standard parts made by many roads were not interchangeable with the same standards made by their neighbors. This did not cause very much inconvenience, but to send all over the continent standard couplers that would not couple with other standard couplers was to be a very serious matter. The Master Car Builders Association could not require all railroad companies to purchase the standard coupler from one maker, but it was of the first importance that all couplers of this type, whoever might be the manufacturer, should couple with any other coupler of the same type. The tendency in making patterns is towards diversity. When different pattern makers were left to provide the form of standard bearing wedge by following drawings, they soon produced wedges that would fit only the boxes they were especially made for. If no proper check were put upon them, pattern makers and molders would soon convert the standard couplers into shapes where strange makes coupling together would be the exception rather than the rule.

After giving this subject the most careful consideration, the executive committee of the Master Car Builders Association adopted a gauge that would measure the contour lines of the coupler and establish a limit of variation from the proper form which must not be exceeded. A gauge to control the dimensions of the knuckle in a similar manner was also adopted. In the construction of these gauges, the Executive Committee had again to provide against the difficulty of diversity in the work of different pattern makers, and of free measuring machinists. If every railroad company was to make its own gauges, confusion worse confounded would meet the couplers that were made to pass their test. To provide against this inevitable cause of confusion, the executive committee made arrangements with the Pratt & Whitney Company to manufacture the gauges, and to sell them nearly at cost. The making of such gauges is work of precision, and developed skill that is costly to employ, and the company named agreed to manufacture the gauges at a certain price if at least fifty sets were ordered, and for a lower figure if one hundred sets were ordered. Considering the important interests involved, we supposed that the required number of gauges would be called for within a month, but three months have passed and the secretary of the Master Car Builders Association has sent out notice, that up to date only twelve sets of gauges have been ordered, and that the proposed makers are waiting for more orders before proceeding with the work of manufacture.

This is not an edifying spectacle. The Master Car Builders' coupler is being applied by the thousands. Within three months the Janney is said to have been specified for over fifteen thousand cars. This improvement costs about $25 a car, and numerous railroad companies have cheerfully incurred the great expense, in the hope that it would lead the way to uniformity and safety. It is then melancholy to reflect that, to avoid a trifling outlay, most of these companies are ready to risk losing the utility of their improvement. They are neglecting to supply themselves with accurate gauges, and if they persist in this course it will inevitably result in the standard coupler departing from the proper form so far that the type will have to be abandoned as impracticable. Many other promising things have been made a failure through inferior workmanship.

Asking Something for Nothing.

Men who would not expect for a moment to ask advice of a lawyer or a physician without paying for it, seem to forget that the same law should hold good in mechanical affairs.

Inventors, and men who are about to invest money in inventions, will walk into the office or the home of some mechanical expert and ask questions, get plans and drawings examined, or seek advice, that none but an educated mechanical engineer would be competent to give, without thinking of paying for the service rendered.

A man who graduates from any of our great technical schools spends more money and more time to get his education than a lawyer or a doctor does.

If a competent mechanical engineer was consulted before any machine or device was placed on the market, there would be fewer failures and disappointments, and it would be a good investment to pay well for their services in any case.

Men who want to use the brains and training of these mechanics, without pay, would resent an impeachment of "sponging" on anybody. Yet to the expert making his bread and butter by using his brains and training, they are very despicable dead-beats.

There is another class of men, or a few of the same class, who seem to think that a mechanical newspaper exists for no other purpose than to do their expert designing for them. They will ask questions in mathematics that any fair scholar in their own place could work out in a few minutes. They want you to design engines for certain work, valve gear for certain engines, and boilers for a dozen different purposes, each stating many local peculiarities that materially affect the case, and where the sound judgment of a first-class mechanic is necessary to insure success.

One of this class wrote us not long ago, asking for the required horse-power, sized boiler, sized screw, pitch of screw, etc., necessary to drive a boat 22 feet long eight miles per hour. Now we do know barely enough about locomotives to get along, but what we know about boats is limited—something like our correspondent's information on same subject. We wrote him that if we were in his place we should employ a competent man to work out the problem, and offered to recommend a mechanical engineer, if he knew of none. We received a postal card reply as follows: "The reeson you don't answer wright is becoss you don't know, you editors aint so smart as you pretend."

The information conveyed in the last sentence of the rebuke came as a great shock to us; but, after calmly thinking it over, we decided not to commit suicide, but to struggle along, as we had before, without knowing everything.

This is the age of the specialist. Each man can learn to be an expert at one thing—if it's only opening clams—and by exchanging products we can all get expert service in everything that goes to make up our lives. An expert mechanic will verify your plans or point out their weak points in a few minutes, and perhaps save you thousands of dollars; but don't expect his services for nothing, nor that he will charge by the hour, he has got to have something for the time spent in educating himself.

Last month, by some unexplainable blunder, the types made us say that the Galena Oil Works had brought the car service of the U. P. "*up* from 13 to 50 cents for a hundred miles." The item was written and should have read: "The Galena Oil Works have brought the car service of the U. P. from 50 cents to 13 cents for a hundred miles." Quite a different story.

W. F. Relyea, air pump expert of the N. Y. Central & Hudson River, has been appointed engine dispatcher at Syracuse, N. Y.

This paper completes its fourth year with this issue. The readers have encouraged it in every way from the very start, and to their enthusiasm we owe much of our happiness as we eat our birthday cake. Just what the paper has done in the past the regular readers know, and nobody else cares. With the next issue we will get rid of kilts, and come out in a regular, made-a purpose suit, and we believe that all who have known us before will be glad to see the improvement. The present owners have not only pooled their editorial work, but have secured the services of several writers of national prominence, who will give our readers series of articles on locomotive engineering subjects during the year With the January issue, one of the best—if not the very best—informed steam engineers of America will commence an A B C series on a steam engineering subject that is a mystery to nine out of ten railroad men His articles will make the matter as plain as daylight, and alone will be worth the price of the paper But he is only a starter. We propose making the most *interesting* mechanical paper out. We think we know how to do it, and only ask that you and our other readers will watch us through '92

Mr. George H. Baker, of Chicago, has been appointed editor of the *National Car and Locomotive Builder*, to succeed Angus Sinclair, who will hereafter be identified with this paper Mr. Baker was formerly an engineer on the Wabash road, but left the throttle at the time of the C., B & Q. strike, to become instructor to the new enginemen for that road. After the strike Mr. Baker went to South America for a year, and has been for some months employed as a fuel inspector on the Southern Pacific road. Mr. Baker will make his headquarters in New York

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A few seem to think that old subscribers will be entitled to the paper next year at the old rates; this is not so. Those whose subscription does not expire until next year will have the new paper after Jan. 1st to the end of their present subscription without extra charge; but all who subscribe or renew after Nov. 1st must pay $2. No more, no less.

Are you on the list for next year? If not, you miss a good thing.

Book Review.

THE PRACTICAL CATECHISM By Robert Grimshaw, M E., Ph D. John Wiley & Sons, Publishers. Price, $1 25

This is a nicely-bound book, and will look well on a library shelf, but seems to be made up of odds and ends from the indefatigable Grimshaw's other "Catechisms" There is something about almost everything in this book lots of it good, but it dodges around from fattening hogs to an untried receipt for weighing the earth. Under the heading of "Locomotives" there are all of three questions asked; they are: "Does the tractive power of a locomotive vary with the speed?" "How can you find the size of rail required for a locomotive?" and "What is a consolidation locomotive?" There may be men in the world who want to know just a little speck about everything, that would appreciate the collection in this work; but to the practical specialist who is trying to be a factor in one branch of usefulness, it will be about as interesting as the unlettered side of a flour sack

CONSTRUCTION AND USE OF MILLING MACHINES is the title of a treatise published by the Brown & Sharpe Manufacturing Company, of Providence, R. I The intention of the book is to give information regarding the machines made by the firm. It performs this purpose in a masterly fashion, and in addition to that it forms an admirable compendium of information on everything relating to milling machines These machines have been largely introduced into railroad shops of late years, and they are rapidly increasing in popularity, but there is still great want of knowledge about them among the mechanics who ought to be thoroughly familiar with every detail of their construction and the means of using them to the best advantage In some shops where the universal milling machine has been introduced, its range of usefulness is greatly curtailed through the men in charge being ignorant of how to use it properly. Those who are in this condition and are anxious to enlighten themselves cannot do better than send for this treatise It will give them valuable information that applies to all makes of milling machines

The first chapters are devoted to describing the construction of the various forms of milling machines, universal and plain The various attachments of the machines are then described and information given about their use. Care and use of milling machines is the next section, and here points are given about placing machines, countershafts, speed, oiling, adjusting, and other facts. A very interesting article from the *American Machinist* on Milling Machines and Skill comes next, and that is followed by quite a treatise on milling cutters. It is hard to select the best part out of a book of this kind, but we think that last mentioned would effect more money-saving reform in tool rooms that we know of than anything else that we have read Use of Milling Machines is a part that treats of how to do work with the machine Numerous particulars are given about the proper methods of doing work, how to run the cutters, speed of cutting for different material, and much more useful information. The book is sold by the publishers Cloth, $1.60; paper, 75 cents.

ASKED & ANSWERED

(73) E. B , Green Bay, Wis., asks:

Why do they split the rim of locomotive driving wheels and then insert pieces? *A.* This is usually done to prevent undue strains being set up in the casting, due to uneven cooling in the mold.

(74) A M B , Banksville, Neb , writes.

There is a boiler of a certain stationary engine working near here, the makers of which said it was tested to 100 pounds cold water pressure, which, they claimed, was equal to 200 steam pressure. Now according to my books this isn't correct. What do you think about it? *A* We think the makers lied

(75) Thos. E. McGinnis, Conneaut, O., asks.

Suppose you break a piece out of a pony truck wheel on a mogul engine; what is the quickest and easiest way to get in? *A.*—It all depends on the kind of track and the distance you must go. If not far, and the track is fairly good, you can block with a tie and slide the truck wheels; if the distance is great you can block over your forward drivers and then chain up the wheels to clear.

(76) Chas. J. Murry, Chicago, Ill., asks:

1. How many square feet of heating surface is there to one square foot of grate surface is the best practice of the present day in the following styles of boilers locomotive, cylinder, return flue tubulars, Scotch flue marine and portable boilers? Please state also how many square feet of heating surface is used to designate one horse-power in locomotive boilers. *A* —1 Locomotive practice varies from the ordinary deep fire box soft coal burners, with an average of 17 square feet of grate for 1,000 square feet of heating surface, to the Wootten fire box, with 80 square feet of grates to 1,250 to 1,400 square feet of heating surface. We cannot give data for other kinds of boilers. 2. The term horse-power is not used in computing size or capacity of locomotive boilers

(77) McG , Galion, O , asks.

Should a tire break on the back driver of an eight wheeler that has bald tires ahead, how can the engine be kept on the track? *A* —Take off the side rods, block up so as to relieve broken tire of weight as much as possible, take out draw-bar between engine and tank, and chain from the end of engine frame on broken side to draw head in tender, keep the tender loaded heavily ahead, and, if necessary, set brake so that the pull of tender, or cars, will have a strong pull to keep the whole flange crowded against the rail. Engines of this kind have been got in by advancing the driving box on the broken side, or bringing the one on good side back; this "slews" the wheels and causes them to crowd to the side; when this is done care should be exercised about clearance, and the main rod lengthened or shortened, to prevent knocking out cylinder heads In usual practice the tank plan is the quickest and best. Run slow.

Special Offer.

Owing to the demand for bound volumes, we have had a large number bound, so that now we can furnish '88, '89, '90 and '91 orders at $2 each. We want to get rid of all back numbers to make room for the new, and make this special offer "To each order for a full set—four volumes—accompanied with the regular price, $8, we will add a full year's subscription to *Locomotive Engineering* **FREE.**" This is $2 clear gain. Of course this can last only as long as we have back numbers, and is only good where the complete four years are taken. The books contain more than 500 illustrations, hundreds of kinks, all of the Progressive Examination Questions and Answers, dozens of John Alexander's stories, and hundreds of answers to puzzling questions. This is your chance.

A correspondent wants to know how to brick up part of a long fire box built for hard coal now used for soft. Perhaps some of our readers have learned something special in experience of this kind, but there seems little else necessary than to thoroughly cover the forward part of the grates as near air tight as possible with fire-brick, being careful to get it tight at flue sheet. A bridge wall at the front, built up twelve or fourteen inches, would aid in keeping fuel off the dead grate, and give benefit, or loss, of a large combustion chamber. Of course, where shaking grates are used, those under the bricks must be disconnected from the shaking mechanism.

Henry M. Sperry, for the past four years signal engineer of the N Y. division of the P. R. R , has been appointed general agent for the Johnson Railroad Signal Co., with headquarters at Chicago.

Work of the Arbitration Committee of the Master Car Builders Association.

Few railroad men, other than the officials most interested, have any idea of the intricate quarrels that arise over the damage and repairs to cars off their home roads.

Perhaps all know that there is a set of rules known as the "Rules of Interchange," that calls for the carding and repairs of defective cars delivered by one road to another road. On the proper inspection and carding depends the fixing of the responsibility and expense of breakages.

As long as men are human there will be disputes, and, where such interests are in conflict, nothing short of angels could always come to an understanding in every case

Where inspectors cannot agree, the case is left to the decision of the Arbitration Committee, which is composed of prominent members of the association, who are also railroad officials in charge of rolling stock

Some of these cases are very interesting, and, for the information of men who know and hear little of this inside business, we publish the work of the committee for its October meeting It may also interest some who think that the pulling out of a draw bar or the smashing in of a car end only represents a delay to them; it costs money to get them back into running order.

CASE No. 88.

The body of Illinois Central car No. 7,607 was destroyed by fire on the Chicago, Burlington & Quincy Railroad. The car was of 50,000 lbs capacity, 40 feet long, and designed and built to carry furniture.

It is claimed that, on account of the increased dimensions of the body, its cost was greater than that of an ordinary box car, and it is therefore billed against the C., B & Q R. R. Co at a figure higher than that fixed in the Rules of Interchange for box cars 34 feet long or over

The C., B. & Q. R. R. Co. expresses a willingness to settle at the figures laid down in the rules, and claims that no more can be charged in accordance with the rules as construed by the Arbitration Committee in Case No. 53.

Both parties to the dispute agree to refer the matter to the Arbitration Committee for decision.

DECISION.

The committee would call the attention of the parties to this dispute to Arbitration Case No. 53, which is a parallel case to that under consideration. The same argument applies, and the opinion of the committee is that the Illinois Central Railroad Co. can only bill in accordance with the figures laid down in Rule No. 23.

(NOTE.—Mr. Rhodes, being interested in this case, was not a party to this decision.)

CASE No. 89.

The Hannibal & St Joseph Railroad Company received from the Gulf, Colorado & Santa Fe Railway Co. C., B. & Q car No. 17,038 with a wrong drawhead. Defect card for the wrong part was issued by the G , C. & S F Ry. Co., and was attached to the car

The H. & St. J. R. R. Co. replaced the wrong draw-bar with another standard to the car, and rendered bill for the cost of replacement against the G , C. & S F Ry. Co.

The bill is disputed by the latter road, on the ground that only the road owning the car can, under the rules, remove the draw-bar, as per Arbitration Case No. 78.

The H. & St. J. R. R. Co. claims that it is a part of the C., B. & Q system, and that, according to the provisions of certain agreements between the roads composing that system, the cars of such roads are repaired at any of the shops on the lines of that system In other words, each of these lines repairs the cars of the others as if they belonged to its own equipment.

Both parties agree to refer the case to the Arbitration Committee for decision.

DECISION.

The Arbitration Committee decided in Arbitration Case No. 78, Texas & Pacific Railway Co. *versus* St. Louis & San Francisco Railroad Co., that a wrong drawhead should be removed only by the company owning the car, unless an intermediate road handling the car deems it necessary to do so, on the ground of safety.

It is not claimed, in the correspondence submitted in the case under consideration, that the removal was deemed necessary on the ground of safety, but that it was made because of an understanding or agreement between the lines composing the C., B & Q. system, of which the H. & St. J. R. R is a part, that the cars of the various lines of that system are to be repaired and maintained at the nearest shop of such lines to which the cars may be The committee has no knowledge of the existence of any such agreements, and, in the absence of such knowledge, can only decide the case under the M C. B. Rules.

The rules provide that a car shall be treated as belonging to the road whose initials it bears. The car in question bore the initials of the C., B. & Q R. R. Co., and this company only is, under the rules, authorized to render a bill upon the authority of such defect card.

In the opinion of the committee there is no ground for a bill from the Hannibal & St. Joseph Railroad Co. against the Gulf, Colorado & Santa Fe Railway Co., but a bill for the repairs in question would be proper if rendered with card by the C., B. & Q. R. R. Co. against the G., C. & S. F. Ry. Co., if there exists such a mutual agreement as is claimed in this case in regard to car repairs on the C., B. & Q. R. R. system, because the H. & St. J. R. R. Co. would then be acting as the duly authorized agent of the C., B. & Q. R. R. Co. in repairing its cars.

As already stated, the committee is of the opinion that, under the rules, the Hannibal & St. Joseph R. R. Co. cannot render a bill against the Gulf, Colorado & Santa Fe R. R. Co. in this case.

(NOTE.—Mr. Rhodes, being interested in this case, was not a party to this decision.)

CASE NO. 88.

July 18, 1890, the Missouri Pacific Railway Co. delivered to the Chicago, St. Paul, Minneapolis & Omaha Railway Co. "O" Refrigerator car No. 8,064, loaded with perishable freight, with pressure-retaining valve missing. The latter road asked for a defect card covering this missing part, which was refused by the inspector of the M. P. Ry. Co. On account of the nature of the freight the car was accepted.

From subsequent correspondence, also submitted, it appears that the C., St. P., M. & O. Ry. Co. requested the M. P. Ry. Co. to furnish a defect card, stating that, under the Rules of Interchange, it is bound to do so. The M. P. Ry. Co. replies that it does not card freight cars for any parts of air-brakes, excepting hose and couplings.

Both parties to the dispute agree to refer the case to the Arbitration Committee for decision.

DECISION.

Rule No. 2 of the Code of Rules states that cars must be delivered in good running order and returned in as good general condition as when received.

In the case in dispute it is not denied by the M. P. Ry. Co. that the car in question was delivered in an improper condition; that is, with the retaining valve missing. The Rules of Interchange do not except this, or any other part of the car, from the operation of the rule cited; the car must be delivered in good order.

Since it is clearly shown, and not disputed, that the car in question was not in the condition contemplated in the rules, the committee is of the opinion that the M. P. Ry. Co. is bound to furnish a defect card for any parts of a car that may be in an improper condition when delivered by it to a connecting line.

CASE NO. 91.

The Chicago & Alton Railroad Co. removed a wrong draw-bar from Mather stock car No. 221, which was applied and carded for by the Cincinnati, New Orleans & Texas Pacific Railway Co. The C. & A. R. R. Co. rendered bill against the C., N. O. & T. P. Ry. Co. for the cost of renewal. The bill is disputed by the latter company, on the ground that, in accordance with decision No. 30 of the Arbitration Committee, the road carding for wrong material is responsible only to the owner of the car. The C. & A. R. R. Co. claims that the Mather Stock Car Company has no repair shops at which these cars can be repaired, and that the railroads operating the cars are expected and authorized by that company to make necessary repairs.

Both parties agree to refer the case to the Arbitration Committee for decision.

DECISION.

There is nothing in the correspondence submitted to show that the C. & A. R. R. Co. removed the wrong draw bar on the ground of safety. If, therefore, the removal had been made solely because the wrong part was carded, the committee would be bound to decide as in cases Nos. 30 and 66, that is, as long as the wrong parts were safe, no one but the owner could remove and bill for them.

The C. & A. R. R. Co. assigns as a reason for doing this work, that the Mather Stock Car Company relies upon the C. & A. R. R. Co. and certain other roads to make necessary repairs to its cars.

This claim is supported by a letter from the Mather Stock Car Company, which is submitted to the committee, and in which it is stated that it has been in the habit of having all roads handling its cars make the necessary repairs.

The C. & A. R. R. Co., therefore, is the authorized agent of the Mather Stock Car Company to repair its cars, and as such, the cost of making such repairs as the road doing the work is not responsible for is a proper charge against the Mather Stock Car Company.

In the case in dispute, the committee is of the opinion that the C. & A. R. R. Co. has no claim against the C., N. O. & T. P. Ry. Co., but its claim is against the company employing it as its agent. If the Mather Stock Car is furnished by the agent repairing its cars with the evidence of the responsibility of another company for the damage to the Mather cars, the Mather Company has its remedy by billing against the proper road in order to reimburse itself for its outlay in paying bills to its agents for repairs to its cars.

In the opinion of the committee, the bill rendered by the Chicago & Alton Railroad Co. against the Cincinnati, New Orleans & Texas Pacific Railway Co. is not in accordance with the rules.

CASE NO. 92.

Pittsburgh, Fort Wayne & Chicago stock car No. 10,011 was delivered to the Louisville & Nashville Railroad, October 14, 1890, and subsequently delivered to the Mobile & Ohio Railroad, which in turn placed it on the tracks of the National Stock Yards Company, at St. Louis, November 3, 1890, loaded with a mixed carload of stock.

March 20, 1891, the P., Ft. W. & C. R. R. Co. learned that the car was still on the stock yards tracks, and in the following damaged condition: One Janney coupler cracked, two Janney knuckles broken, one short brake chain gone. The P., Ft. W. & C. R. R. Co. applied to the M. & O. R. R. Co., and also to the National Stock Yards Company, to return their car, neither of which companies would do so, or assume any responsibility in the case. The M. & O. R. R. Co. claims that it is customary to immediately set back all cars going to the stock yards in bad order, for repairs or to be properly carded, and that as this car was not set back when they delivered it, it is evidence that the car was in good condition. The St. Louis National Stock Yards Company denies all knowledge of the case, and claims it has no means at its disposal of knowing anything about the matter. In order to get the car into service, the P., Ft. W. & C. R. R. Co. requested a neighboring line to receive the car and repair it, and get it into service, which it did, at an expense of $16.70. Both the P., Ft. W. & C. R. R. Co. and the M. & O. R. R. Co. agree to refer the matter in dispute to the Arbitration Committee.

In order to better get at the relations of the St. Louis Stock Yards Company with the railroad companies at East St. Louis, one of the members of the Arbitration Committee visited East St. Louis and learned as follows: The National Stock Yards, including the necessary tracks, are owned by the company of that name. There are also located on the property of that company certain packing houses and tracks leading thereto. A number of the railroad companies centering at East St. Louis have track connection with the Stock Yards tracks, while others reach them by trackage rights over roads having direct connections, or have their work done by one or more of the switching roads. The M. & O. R. R. Co. does not connect directly with these tracks, but reaches them by trackage rights. The National Stock Yards Company owns and uses one engine for its own convenience in cleaning up the yards, switching hay and ice, etc., from one packing house to another. The roads reaching the yards over their own tracks, or by trackage rights, do their own work at the yards proper and at the manufacturing establishments, in consequence of which there may be as many switching engines and crews working there as there are roads. The practical result of this is that each crew has to wait its turn to do its work, which in the case of the work at the manufacturing establishments frequently involves the rehandling of cars just previously handled by another crew. On live stock handled at the yard no trackage charge is paid to the National Stock Yards Company for the use of its track, but for all dead freight handled over its tracks that company receives $1 per car for such use of its tracks. The National Stock Yards Company has never assumed or admitted any responsibility for damage to, or destruction of, cars on the tracks situated on its property. It does not inspect or receive cars from the different railroad companies, and there is no inspection of cars as between railroad companies and the National Stock Yards Company. It is customary for the road which delivers a car at the stock yards to take it out again, but there is no set rule formulated governing the matter, and as so many roads have access to all the tracks, it is possible for a road to take out cars which it did not set in, or to leave cars there that it did set in.

Both parties agree to refer the case in dispute to the Arbitration Committee for decision.

DECISION.

It is clear from the above that the tracks of the St. Louis National Stock Yards Company must be regarded as private tracks, and cars found on them in damaged condition must be governed by M. C. B. Rule No. 28, which reads as follows: "For the mutual advantage of railroad companies interested, the settlement for a car owned or controlled by a railroad company, when damaged or destroyed upon a private track, shall be assumed by the railroad company delivering the car upon such tracks," and railroad companies making use of private tracks can only avoid sustaining loss on account of damage upon such private tracks by specific agreements with the owners of the private tracks to reimburse the railroad companies for the cost of damage sustained while on the private track by cars which the railroad companies deliver thereon.

The committee is of the opinion that the Mobile & Ohio Railroad Company is responsible for the damage, and should pay for the same as prescribed by the rules.

(NOTE.—Mr. Casanave, being interested in this case, was not a party to this decision.)

CASE NO. 93.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Co. destroyed on its line, May 23, 1890, body of Atlantic & Pacific box car No. 316. The trucks were returned to the owner.

The A. & P. R. R. Co. rendered bill against the company destroying the car for the depreciated value of the body, dating from the time it was rebuilt, namely, June 12, 1889.

The C., C., C. & St. L. Ry. Co. objects to the bill, on the ground that the car was only 28 feet long, and that it is probable that the date at which it is claimed the car was rebuilt is an error. It claims that the car must have been much older, and asks that the road rendering bill make necessary correction.

The A. & P. R. R. Co. states in reply that this car was rebuilt at its shops June 12, 1889, and had new posts, braces, belt rail, flooring, siding, roofing, lining, grain doors, brakes and draft timbers, and received other trucks, and it considers this car, when leaving shop at the time mentioned, equal to a new car. The A. & P. R. R. Co. acknowledges, however, that the original car was built July, 1881, at a cost of $580.

Both parties agree to refer the case in dispute to the Arbitration Committee for decision.

DECISION.

Arbitration Case No. 71 is a parallel case to that under consideration.

It is the opinion of the committee that the M. C. B. Rules contemplate that the depreciation shall date from the time the car was actually built.

It is admitted by the A. & P. R. R. Co. that the car in question was only partially rebuilt in 1889, and although the work done was very extensive, yet, when completed, the car was not a new car.

The committee is therefore of the opinion that the depreciation must be computed from the date the car was actually built.

The recent fast run with an experimental train over the New York Central from this city to Buffalo, has satisfied the management that a run nearly as good can be made every day. On Oct. 26 they put on the "Empire State Express," which leaves New York at 9 A. M., and arrives in Buffalo at 5:40, covering the 440 miles in 8 hours and 40 minutes, or at the rate of 52.3 miles per hour. The train will consist of four cars.

The ordinary car builder does not like to make cabs—it's too much like cabinet making. Around every shop there is always kept a handy man who makes cabs, pilots, seat boxes, and, occasionally, works in a fancy tool-chest for one of the boys. The illustrated article on cab building on another page will, no doubt, be appreciated by men who are looking for a good way to do their work.

It is now proposed to paint all electric wires that carry a dangerously high current, red. This may keep people from touching them, but it won't prevent their contact with other wires from sending death and destruction through telephone and messenger calls, clothes lines and house gutters. Bury them.

The *Express Gazette* stole the Old Timer's story about the scared Indian from our columns, and now it's going the rounds credited to the thief. Thus the patient husbandman sows good pumpkin seed with the sweat of his brow, and the middleman gathereth in the fruit and leaves the sweat.

Some of the coal furnished by New England roads to haul passenger trains with, looks and burns more like bran mash than bituminous coal. This wouldn't be so bad if the officials would only refrain from telegraphing for cause of delay.

We have bound volumes for 1888, '89, '90 and '91 on hand, four years, at $2 per volume. You cannot get them in three months from now. Order now.

The Baldwin Locomotive Works have adopted a rule to make all boilers for compound locomotives with a factor of safety of five.

E. Brunton has been made Supt. M. P. & M. of the Florida Central & Peninsular, vice M. J. Rogers, resigned.

The Pittsburgh Locomotive Works are building twenty Forney engines for the Manhattan Elevated Railroad.

The Pennsylvania have recently ordered five Baldwin compounds.

There has been a car famine in the West for the past month.

Improvement in Cutting Tools.

During a recent visit to the Gould & Eberhardt works, at Newark, N. J., we were very much interested in the system of cutting tools in use in the machine shop. The cutting tools for all lathes, planers and all other machine tools are made from small bar steel large enough to give the shape of a cutting face, and this is separate from the holder piece that goes into the tool post. This holder is made of malleable iron and the cutter slips into a hole of the proper size, and is held by two set-screws. The holders are made of such forms that the cutters can be set at the angles required of any tool made in the usual way. The piece of steel that forms the cutter does not require any forging, merely grinding. The system has been developed by Mr. Eberhardt, and has been in use in these works for several years. The firm is now about to put the cutters and holders upon the market.

The advantages of the system are apparent to any mechanic who has paid the least attention to the loss of time that results from waiting for tools to be dressed. Here a workman has merely to keep a few of the cutters ground, and he always has a supply of new tools at hand.

The firm makes the following claims of advantages for the tools :

Economy in grinding; no forging or tempering; tool supported up close; no objectionable projections; no stock of heavy steel on hand; average cutting rake always given; no adjustment of height necessary; time, labor, money and annoyance saved; variety of cutting shapes ground R. and L.; increased speeds and feeds can be obtained; grinding of tools required less frequently; steel will not slip in holder under heavy cuts.

We should strongly advise men in charge of machine shops who are looking for improved methods to apply for full particulars about this system of cutting tools.

At a recent meeting of the Western Railway Club, Mr. Synnestvedt, of the Chicago & Northwestern, in speaking of exhausting all the air out of the pipe in testing brakes, said : "I think the practice of drawing all the air out very valuable for several reasons—the reasons already given here, and one other which I will mention. You can tell it within several cars of the length of the train by the length of the blow-out of the train pipe exhaust. You can tell it also when you are running on the road, while you are making an application. But there is another thing which makes it very important to let all the air out of the train pipe in making the test of brakes; you may have some cars the reservoirs on which are not filled. I have seen an extra car—a sleeper or a diner—attached to a train; they stand a moment, and the brakeman gives the engineer the signal to try the brakes, the car just connected has less air than the others, and its brake does not go on, and I have seen men make three or four, and sometimes more, applications of the brake to satisfy the brakeman that it was all right. All that trouble would have been avoided had the engineer exhausted all the air from the train in trying the brakes. There is a way which I have not heard mentioned, by which an engineer can test the length of the train pipe while running on the road, without making an application of the brakes at all, and by which he can tell within two cars. If the engineer's valve handle stands in the proper position, one gauge pointer will show 20 pounds excess pressure. Now, by pushing the handle to the release position and watching how far the red pointer falls, you can tell very nearly how many cars there are in the train. We find that when there are fifteen cars in the train, it will go down almost exactly a pound to a car; the longer the train the less per car. Suppose a man is running on a dark night and has a meeting point or a crossing to make; he may have a suspicion that all the brakes are not set in. He can tell very easily by slipping the handle around and watching the red pointer, as I say. I have often done this, and guessed the number of cars, and then gone back and counted them, and I never missed by over four cars, even on trains of fifteen or sixteen cars."

The Brooklyn Elevated road have received some more compounds from the Rhode Island works; they are two-cylinder machines.

The makers of steam gauges for locomotives are finding difficulty in keeping their gauges in good working order under the high temperature they are subjected to in the hot cabs to be found on some of our high-pressure locomotives. In talking of this to Chief Henderson, of the Boston Navy Yard, lately, he related a curious experience with a steam gauge. It was correct when tested on the mercury column, but when it was in place its record was of the most erratic character. A careful examination revealed nothing to be wrong with the mechanism of the instrument, and the case was becoming a mystery, when some one loosened the screws that held the gauge to the stand. It registered the correct steam pressure immediately. The trouble was that the gauge mechanism was secured to the back plate, and the pressure of the stand distorted that plate, throwing the register astray. The Ashcroft Manufacturing Company provide against this cause of distortion in their gauges by securing the actuating mechanism to the spring stand itself. This is reported to be an effectual remedy

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The Leach improved sanding apparatus is meeting with great favor among railroad companies, and those who are using it generally admit that, besides making a supply of sand last from four to ten times as long, its use saves tires and rails from destructive wear. Some railroads noted for slippery rails, caused by the presence of dust having a lubricating tendency, have found that the use of the Leach sander on their locomotives enables them to get along without carrying an extra supply of sand on the engines. One of these sand boxes was placed on a particularly slippery locomotive belonging to the Old Colony Railroad engaged on suburban business, and the regular supply of sand at the right spot effected a great improvement on the engine. The engineer was in the habit of keeping the supply running all the time, and this acted so well as a preventive of wheel sliding that the intention is to apply the sander to all suburban engines, and keep it in use all the time when the trains are in motion.

A peculiarity about the car and locomotive shops of the Delaware & Hudson Canal is the many uses that hydraulic lifts are put to. If manual labor can be economically saved by the introduction of a hydraulic crane or jack, the water pressure is made to do the business. Mr. Blackall is a warm advocate of this means of labor saving, and he keeps down the pay-roll very materially by the practice followed. At present, they are putting into every engine-house a hydraulic elevator which raises an engine and performs the functions usually performed by drop tables. A hydraulic elevator capable of lifting the heaviest engines can be put in at a total expense of $1,200. It is found much more convenient than a drop table, and does the work more quickly

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The people who buy dummy couplings for air-hose, and then fasten them to the end of the car in such a position that the hose cannot be coupled to them properly, should be clubbed. Sometimes they do couple, but do so at so great a strain as to bend the hook, thus defeating the object of dummy couplings, which is to cover the opening in the hose. The ordinary dummy coupling is of no earthly use unless it prevents dust and cinders from getting into the hose. It's a wonder that some of the brakes on the D., L. & W. passenger trains work at all, and this road is little worse than many others we could name. A couple of links or a swivel between the coupling and the car prevents cramping the hose or placing too much strain on the back hook

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If any one wants to see discomfort in an advanced stage of decomposition, he wants to get on a locomotive with dirt-burner boiler when the wind blows hard. The grates being above the wheels, the back of the ash-pan is entirely open for about 18 inches deep and 8 feet wide, right under the fireman's nose. Into the immense ash-pan the gentle zephyrs always go by the front damper and air-holes, and, escaping from the back in the shape of an ashen simoom, they make the patient "firesy" look like a chimney-sweep and feel like a tramp bent on murder.

The Central of N. J. will try a compound.

The Best They Can Do in England.

The highest speed ever attained on a railway was accomplished on the Northeastern Railway by one of their new compound single engines. The engine (No. 1,518), with a train of 18 carriages, attained the enormous speed of 86 miles an hour. The total weight of train and engine was 310 tons. —*Ryland's Iron Trade Circular*, London.

The official statistician of the Interstate Commerce Commission gives the following as official on the number of locomotives and cars in this country :

"There are about 30,000 locomotives in the United States, of which one-half are used in hauling freight trains. It is estimated that these iron horses cost $450,000,000 There are 1,100,000 cars of all kinds, of which 26,000 are passenger cars and the remainder freight or service cars. The former cars cost about $250,000,000 and the latter $800,000,000, or an approximated cost of rolling stock of $1,500,000,000.

"To every five miles of railroad in the United States there is a locomotive ; to every mile of road there are six freight cars ; to every five and one-half miles there is a passenger car. Each year a freight engine hauls 35,000 tons of load , each year a passenger engine pulls 60,000 passengers. The railways of the United States employ 725,000 persons. It is estimated that the railway interest provides a living for 3,000,000 in this country, or nearly one-twentieth of the population."

Few persons have an adequate idea of the care required to maintain the electric block signals which make it possible to safely run heavy and fast trains in and out of cities at intervals of a few minutes, regardless of the state of the weather. Batteries, the circuit and its insulation, require careful watching, and the batteries especially demand intelligent care if they are to be kept in the best of condition to insure perfect working signals. G. L. Lang stated to the Association of Railway Telegraph Superintendents that the annual cost per signal for maintenance of double track block signals is not far from $40 per annum, varying somewhat according to the traffic.

It may seem a small matter to adopt an automatic car coupler, said Mr. M N Forney, speaking before the Railroad Commission. It was a small matter to adopt a standard screw thread, yet look at the labor which this involved. Mr. Chanute, on the Erie, was the first to attempt to bring some order out of the chaos that existed. He tried to get the U. S standard threads He sent to the Navy Yard for gauges, but they did not agree, he applied to Pratt & Whitney for them, but they had no tools to make them. At last this firm undertook to make special tools for doing the work, and it was only then that screw threads could be found that were really of uniform size.

Does your headlight wick "crawl up" after you get running, and break chimneys, and smoke up things generally ? When cloth wicks are used this trouble is pretty general, and is caused by the wick sticking in the burner—a home-made wick will stick on the lap side. When you turn the light up, about where you think it ought to stand, you like to have it stay there, but if the wick is fairly loose it will jar up, or the movement of the oil works it up. The trouble is that it is wrinkled and can straighten up. Turn it far too high, and adjust it by turning *down*—it won't work up then.

The Boston & Maine Railroad Company have lately ordered 25 passenger cars from the Laconia Car Company. The cars will have all the latest improvements, including quick-acting air-brakes and steel-tired wheels. This company has lately changed from yellow to the Pullman color for their passenger cars. They have also ordered 500 freight cars.

Get things handy in the cab. We recently rode on a locomotive where the cock for starting the bell-ringer was under the engineer's brake valve, on the right side. Every time we approached a town the "firesy" would go over and reach for it. We thought for some time that he was feeling of the engineer's shin bone to see if it was running hot.

The Lee Composite Mfg. Co., 29 Broadway, N. Y., report a steadily increasing demand for their products. Among the roads using their "Slagphalt" paint on passenger car roofs are the N. Y., S. & W., N. Y., Ont. & W.; D. & H., South Carolina, B. & A.; P. & R., Staten Island Rapid Transit, N. Y., Prov. & Boston, and others. "Slagphalt" prevents cinders from locomotives from cutting the tin, and protects it from the action of acids. Coaches next the engine so treated, after many months' service, it is claimed, show absolutely no evidence of attack from "cinder blasts."

The Old Colony Railroad Company have estimated that it would cost them $198,000 to equip their 265 locomotives and 600 passenger cars with the apparatus required to heat their cars with steam. The management made numerous wry faces over the figures, but they finally said let her go, G—Lauder, and steam heat it is.

The New Haven road have recently bought some new boilers from a builder and made engines for them in their own shop, to take the place of some old ones that have been put on the "scrap heap run." This, and a good many other eastern roads, could keep pretty busy for a few years at this kind of work with profit.

E. J. Desoe, a rising young engineer on the Boston & Albany road, has been selected by the management as air brake instructor for the system. Mr. Desoe can well feel proud of his preferment, as it was made for merit; his work will tell in better service.

Rogers Locomotive Works are building some eight-wheelers for the S. F. & W., ten ten wheelers, with Wootten fire boxes. They also have twenty-five for the C., B. & Q.—they are of the ten-wheel type—for the C., B. & N. Division.

The turnbuckle department of the Central Iron & Steel Co., at Brazil, Ind., was partially burned on Oct. 30th. They were clearing up the wreck before the smoke cleared away, and the plant is again in full operation.

The Finance Committee of the Erie Railroad has decided to recommend the payment of a 3 per cent. dividend on the preferred stock. If such a dividend is paid a non paying record of about fourteen years will be broken.

On the N. Y., N. H. & H. all the bell cords run in on the engineer's side; there is a State law in Connecticut that the engineer must ring the bell. There are no running boards on this company's engines.

H. V. Wilkins, of the Illinois Central, has been promoted to the position of general foreman in charge at Durant, Miss.

The Columbus, Hocking Valley & Toledo are having ten heavy engines built at the Pittsburgh Locomotive Works.

The Big 4 contracts for 40 coaches, 20 engines and large number of freight cars have not yet been given out.

The report that the Seaboard Air Line are in the market for 500 cars is contradicted by reliable authority.

The Lehigh Valley Car Co. have orders for 500 gondolas for the Central of New Jersey.

The Pennsylvania R. R. Co. are letting contracts for 5,000 freight cars.

It is rumored that the Central of N. J. are getting bids on 500 box cars.

The Lehigh Valley are reported to be in the market for 2,000 freight cars.

The N. Y., S. & W. will probably place orders for 200 freights.

The West Shore are getting bids on 500 freight cars.

Model Motive Power.

The Baltimore & Ohio Railroad Company has recently placed in service on its fast trains, between New York, Philadelphia, Baltimore and Washington, six new engines, which are doubtless the finest and fastest ever built in this country. These new flyers have driving wheels six feet six inches high, and cylinders 20 inches by 24. The large cylinders give them tremendous power, and the high drivers protect the machinery from the rack and strain incident to driving smaller engines at great speed. There is practically no limit to the speed to which these new marvels may be driven, and they skim over the rails as smoothly as a swallow over a lake.

Another recent addition to the motive power of the company is a consignment of eight powerful ten-wheel passenger engines, designed for service on the mountain divisions. These are the heaviest ten-wheel engines ever constructed, weighing sixty-seven and one-half tons. They have driving wheels six feet two inches high, and cylinders 21 inches by 26. One of these machines performs the work heretofore requiring two of the ordinary class, and they take the heavy through express trains up the mountain grades quickly and with perfect ease.

The Mt. Clare shops of the company have recently completed an order for ten switch engines of the highest type, and sufficiently powerful to make up a train equal to the full drawing power of a consolidation freight engine. Also three new heavy eight-wheel passenger engines, having driving wheels five feet eight inches, and cylinders twenty inches by twenty-four. These engines are now doing excellent work; they are very powerful, and susceptible of great speed.

In addition to the foregoing, the company has now under construction at its Mt. Clare shops ten powerful ten-wheel engines designed for fast freight service and for heavy passenger trains on occasion, also twelve consolidation freight engines of great power.

PROSPECTUS OF

Locomotive Engineering

FOR 1892.

With the January, 1892, issue, THE LOCOMOTIVE ENGINEER will take the above title, come out with a large 4-column page, and a substantial increase in the number of them—anyway twenty big pages of reading matter.

ANGUS SINCLAIR, for the past six years Editor of the NATIONAL CAR AND LOCOMOTIVE BUILDER, the author of "Locomotive Engine Running and Management," well known as the Secretary of the American Railway Master Mechanics' Association, and JOHN A HILL, Editor of THE LOCOMOTIVE ENGINEER from its birth, have bought out the paper and will devote all their energies to making it the best practical railroad paper in the world.

It is proposed to keep it up to the times and devoted exclusively to subjects interesting to all men in the motive power and rolling stock departments of American railroads.

Old readers of THE LOCOMOTIVE ENGINEER shall not miss a line of Mr. Hill's work, and will in addition secure all the writings of Mr. Sinclair.

The new owners propose to spend a large sum of money next year for engravings to keep up the interest of every engineer, fireman, shop man and officer in the machinery department

The working, every-day engineers, firemen and shop men of our railroads have been slandered by papers containing little of interest to practical men, which have long contended that enginemen would not read a railroad paper, much less pay for one. Four years' experience with THE LOCOMOTIVE ENGINEER has proven the falsity of this claim—16,000 names are now on the list. The men *will* read, and profit by it, if practical matter by practical men is furnished, instead of abstract reasoning and cloudy theories. Both editors of this paper have bent their backs to the coal scoop and taken care of the reverse lever, the throttle and the 3-way cock. "Been there."

Now, this enlarged paper will be worth $2.00—can't furnish it a cent less—all we ask is that you will try it for one year; if you are willing to give it up then we won't say a word. Are you with us?

ABOUT CLUBS.

We pay a cash commission for getting up clubs. If there is no one at work in your field, write us for club rates.

FINALLY.

We do not like to make a lot of promises, blow our own horn and swell up prematurely. We have plenty of new matter laid out, a lot of historical railroad lore as interesting as a novel, some new departments to add, some elementary matter of the right sort, and engravings galore—we propose to lay awake nights scheming to make the paper valuable and interesting to our readers. Our time and abilities shall be all yours. But we would far rather you would tell us how well we have succeeded in a year from now than to blow about it in advance. Will you be on the jury?

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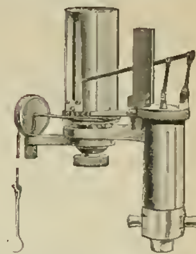

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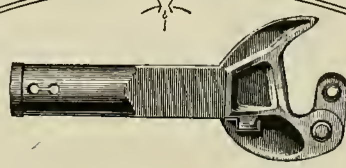

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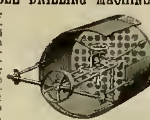
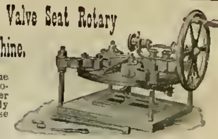
For fitting new or old cylinders to locomotive boilers. It will drill all the holes in smoke boxes and cylinder flanges necessary to bang one pair of cylinders at one setting of the machine. Quickly set and operated. Driven by hand or belt power.



Patent Portable Valve Seat Rotary Planing Machine.

Will face off the Valve Seats of Locomotives and other Engines perfectly true, without the use of files or scrapers.



Patent Portable Locomotive Cylinder Boring Machine.

Will bore out Locomotive Cylinders in their places by removing one or both heads, as desired, and piston. The end thrust is always in exact line with bar. It is fed with constant feed of cut gears

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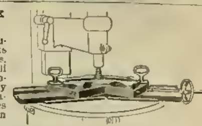
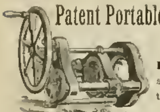
For rapidly and accurately Milling out Links to any desired radius. Can be used on Drill Press or as an attachment to our Heavy Universal Milling Machine. A link 20 inches long can be finished in four hours.





Patent Portable Crank-Pin Machine.

For turning off Crank-Pins IN POSITION and while wheels are under the Engine, keeping the original centers of the Pin.

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Facing Locomotive Brasses.

Will hold any size brass same as held by strap when in use. No more time required to place brass than screw up an ordinary vise. Any desired thickness of cut can be taken, jointing the faces perfectly true. No files required.

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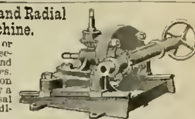

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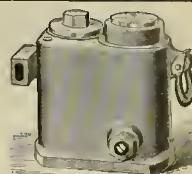

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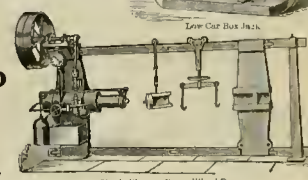

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